Chronic Diseases in Canada

Volume 30 · Number 2 · March 2010

Inside this issue

39 Preface – Careers in epidemiology
J. Last

40 Alberta Aboriginal Head Start in Urban and Northern Communities: longitudinal study pilot phase
A. M. dela Cruz, P. McCarthy

46 The comorbidity burden of the treated asthma patient population in British Columbia
R. Prosser, B. Carleton, A. Smith

56 Gender, social relationships and depressive disorders in adults aged 65 and over in Quebec
S.-D. Mechakra-Tahiri, M. V. Zunzunegui, M. Preville, M. Dubé

66 Book review – Statistical detection and surveillance of geographic clusters
B. Dufault

Public Health Agency of Canada
Agence de la santé publique du Canada

Canada

Chronic Diseases in Canada
a publication of the Public Health Agency of Canada

CDIC Editorial Board

Howard Morrison, PhD
Editor-in-Chief
(613) 941-1286

Robert A. Spasoff, MD
Associate Scientific Editor

Claire Infante-Rivard, MD
Associate Scientific Editor

Elizabeth Kristjansson, PhD
Associate Scientific Editor

Michelle Tracy, MA
Managing Editor

Robert Geneau, PhD
Public Health Agency of Canada

Isra Levy, MB, FRCPC, FACPM
Ottawa Public Health

Heather Logan, BScN
Canadian Association of Provincial Cancer Agencies

Lesli Mitchell, MA
Centers for Disease Control and Prevention

Scott Patten, MD, PhD, FRCPC
University of Calgary

Barry Pless, CM, MD, FRCPC
Montreal Children's Hospital

Kerry Robinson, PhD
Public Health Agency of Canada

Fabiola Tatone-Tokuda, MSc (c)
University of Ottawa

Andreas T. Wielgosz, MD, PhD, FRCPC
Public Health Agency of Canada

Don Wigle, MD, PhD
University of Ottawa

Russell Wilkins, MUrb
Statistics Canada

Chronic Diseases in Canada (CDIC) is a quarterly scientific journal focussing on current evidence relevant to the control and prevention of chronic (i.e. non-communicable) diseases and injuries in Canada. Since 1980 the journal has published a unique blend of peer-reviewed feature articles by authors from the public and private sectors and which may include research from such fields as epidemiology, public/community health, biostatistics, the behavioural sciences, and health services or economics. Only feature articles are peer reviewed. Authors retain responsibility for the content of their articles; the opinions expressed are not necessarily those of the CDIC editorial committee nor of the Public Health Agency of Canada.

Chronic Diseases in Canada
Public Health Agency of Canada
785 Carling Avenue
Address Locator 6805B
Ottawa, Ontario K1A 0K9

Fax: (613) 941-9502
E-mail: cdic-mcc@phac-aspc.gc.ca

Indexed in Index Medicus/MEDLINE, SciSearch® and Journal Citation Reports/ Science Edition

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.
— Public Health Agency of Canada

Published by authority of the Minister of Health.
© Her Majesty the Queen in Right of Canada, represented by the Minister of Health, 2010
ISSN 0228-8699

This publication is also available online at www.publichealth.gc.ca/cdic
Également disponible en français sous le titre : *Maladies chroniques au Canada*

Preface to the 2009 CSEB* Student Conference abstracts on chronic disease

Careers in epidemiology

John Last, MB, MD, DPH

One of the pleasures of life in my old age is to be reinfected with youthful enthusiasm by contact with young people. It doesn't matter much whether that contact is direct (face-to-face) or indirect, via the medium of the written (or these days the electronic) word. Face-to-face interaction seems manifestly preferable until I reflect on it at leisure and realize that when it's written down, it can be recalled to my computer screen whenever I want. This has equal though different advantages. I was privileged to enjoy both at the time of the graduate student conference preceding this year's CSEB Conference in Ottawa.

The papers presented by the graduate students cover a wide range of subjects; many are of very high quality, promising a bright future for epidemiological research and practice. I had the pleasure of addressing them all on the subject of their choice, careers in epidemiology, and of interacting with many during the reception that evening and during the CSEB Conference that followed.

There is some dissonance between the proportional share of career directions suggested by the current preoccupations of Canadian graduate students and my perception of the domains of maximum future concern in epidemiology. In my own presentation to the CSEB Conference I tried to cover almost the whole broad territory of epidemiology; but I did suggest that an imminent need exists for many more epidemiologists to get involved in environmental epidemiology, and particularly in research and surveillance of the impacts of global climate change on human health. I was a little disappointed that only one paper at the student conference directly addressed health impacts of climate on health, although many more dealt with other topics in environmental epidemiology. Much more work, some of it quite urgent, is needed on, for instance, surveillance criteria, risk assessment, and evaluation of intervention strategies, in relation to the imminent health threats attributable to climate change.

The future challenges in research and surveillance of the health impacts of climate change are numerous and daunting. But they are increasingly urgent. I hope the full energy and intellectual capacity of a large proportion of the generation of epidemiologists represented at the student conference in Ottawa this year will be concentrated on this important domain.

The 2009 CSEB Student Conference abstracts on chronic disease can be found in the online edition of Chronic Diseases in Canada at: http://www.phac-aspc.gc.ca/publicat/cdic-mcc/30-1/cseb_01-eng.php

* Canadian Society for Epidemiology and Biostatistics

Alberta Aboriginal Head Start in Urban and Northern Communities: longitudinal study pilot phase

A. M. dela Cruz, MSc, BN (1); P. McCarthy, Associate Degree in Applied Science (2)

Abstract

Aboriginal Head Start in Urban and Northern Communities (AHSUNC) is a federally funded, national, early childhood intervention strategy that addresses the needs of Aboriginal preschool children and their families. A pilot study, based on principles of community-based research, evaluated an Alberta Aboriginal Head Start (AHS) program offered off-reserve in Alberta. Overall, the results pertaining to children having followed an AHS program are positive. This phase 1 of a broader longitudinal evaluation study of all AHS sites in Alberta has led to the creation of several recommendations, which reinforce this type of evaluation and look to mitigate the limitations encountered in phase 1 (around available data, tools and context).

Keywords: *Aboriginal Head Start, longitudinal evaluation study, community-based research, early childhood intervention strategy, Alberta*

Introduction

Aboriginal Head Start in Urban and Northern Communities (AHSUNC) is a federally funded, national, early childhood intervention strategy that addresses the needs of Aboriginal preschool children and their families living in urban centres and in northern communities. It strives to instil a sense of pride and confidence, to foster a desire to learn and emotional and social development, to provide parenting skills and to improve family relationships. In Canada, Aboriginal Head Start (AHS) programs are administered both on- and off-reserve. Funded by the Public Health Agency of Canada (PHAC), there were (as of June 2008) 16 sponsors who were implementing 21 AHS programs across Alberta.

AHS programs in Alberta typically provide a preschool experience for children to prepare them for their school years, and provide opportunities for spiritual, emotional, intellectual and physical development. From a population health perspective, early childhood intervention strategies contribute to the health and well-being of children in the short- and long-term; they affect children's school readiness and health, and ultimately their health and well-being as adults. In contrast, poor childhood development can result in poor physical and mental health, including chronic diseases, throughout life.[1]

All AHS sites provide programming in six core areas: education and school readiness, Aboriginal culture and language, parental involvement, health promotion, nutrition, and social support. Class sizes range from about 10 to 20 students, and programs are implemented either as half-day (morning or afternoon) or full-day programs. Also, AHS directly involves parents and the community in the management and operation of projects; parents are supported in their role as the child's first and most influential teacher, and the wisdom of Elders is valued.

All AHS sites in Alberta are members of the Alberta Aboriginal Head Start (AAHS) Provincial Committee. This committee includes all AHS sponsors in Alberta and representatives from the provincial and federal governments, including regional PHAC staff. In 2007, the AAHS Provincial Committee identified the need to conduct an evaluation of AHS programs in Alberta,[2] and a consultant was hired to develop different options and approaches to conduct a longitudinal evaluation study. In 2008, further discussion took place within the AAHS Provincial Committee regarding the opportunity and potential to conduct a longitudinal evaluation study that would examine the impact of the AHS program by comparing development among children who attend AHS programs and those who do not, thus determining whether the program is, in fact, working as intended.

The committee decided on a community-based research approach to ensure that the relevance of the research topic was identified and verified by community members; that the resources for research (finances, expertise and personnel) were shared with community members and key stakeholders, particularly those most affected by the study topic; that the research process recognized and utilized the expertise that community members have; and that the research process and results were accessible to and understood by community

Author References

1 Evaluation Consultant, Public Health Agency of Canada, Alberta Region

2 Chair, Alberta Aboriginal Head Start Provincial Committee

Correspondence: Aniela M. dela Cruz, Public Health Agency of Canada, Alberta Region, 620 Harry Hays Building, 220 – 4th Avenue SE Calgary, Alberta T2G 4X9, Tel.: (403) 292-6714, Fax.: (403) 292-6696, E-mail: aniela.dela.cruz@phac-aspc.gc.ca or adelacru@ualberta.ca

members.* Such principles are also aligned with those created by the National Aboriginal Health Organization (NAHO): ownership, control, access, and possession (OCAP).[3]

Purpose and objectives of the AAHS longitudinal study pilot phase 2007/2008

Currently, Alberta AHS sites are involved in evaluation-related activities that help inform programming improvements. However, these evaluations focus more on process-oriented measures. Here we report on the results of a pilot study that will help plan for a broader longitudinal study in Alberta that would examine the impacts of the AHS program.

The purpose of this study was to conduct a pilot longitudinal evaluation study in one Alberta AHS site to assess the feasibility of longitudinal evaluative studies of AHS programs in Alberta and to plan for future studies.

There were three objectives of the AAHS Longitudinal Study Pilot Phase 2007/2008: to develop and implement an evaluation plan for the longitudinal pilot study that assesses areas such as school achievement, social skills and school readiness among Alberta AHS graduates; to develop an evaluation plan that is consistent with a community-based approach; and, based on the pilot results, to develop and present an evaluation plan for a broader longitudinal study of the Alberta AHS program for 2008–2012, including an estimate of the budget and resources required to complete a full study.

This pilot study was part of Phase 1 of the longitudinal evaluation study of the AHS program in Alberta. It is anticipated that a broader evaluation study will be conducted across all AHS sites in Alberta in the next three to five years.

Methods

A research team was hired, based on their extensive experience and knowledge of Canadian AHS programs and Aboriginal communities, to assist in the implementation of the pilot study. Their recommendation to use a post-test design to conduct the pilot study was based on budget limitations, time constraints (the pilot study was funded by the Alberta Regional PHAC office and thus all pilot study activities had to be completed within the fiscal year, as well as within the AHS school year), and the lack of baseline or pre-test data, which meant that pre-test and post-test outcome results could not be compared.

Sample and participants

All Alberta AHS sites were given the opportunity to participate in the pilot study; some chose not to due to conflicts with school activities and an inability to commit to the particular timeframe. This AHS site was chosen based on the school's voluntary participation as well as the support for the pilot study offered by the school administration.

The AHS pilot study was based in a small rural off-reserve community of approximately 550 people 400 kilometres northwest of Edmonton, Alberta, where the AHS site has been in operation for approximately 11 years. Situated in the local school, the AHS site shares the school's resources such as gymnasium space and food programs. The program is child-centered with emphasis on language development, socio-emotional well-being and learning through play. At the time of the pilot study, there were 20 children aged 3 and 4 years attending the AHS program. Nearly all children who attend the AHS program continue with their education at this school.

Of the 64 children enrolled at the AHS site, 48 (75%) participated in the pilot study. Reasons for non-participation of students included non-attendance and lack of informed consent.

The average age of the Early Childhood Services (ECS) children who participated in the pilot study was 5.7 years for children who completed AHS and 5.2 years for those who did not attend AHS, or Non-Aboriginal Head Start (N-AHS) children. In Grade 1 the average age was 6.5 years for AHS children and 6.6 years for N-AHS children; in Grade 5 the average age was 10.5 years for AHS children (there were no N-AHS in Grade 5); in Grade 6 the average age was 11.6 years for AHS children and 12 years for N-AHS children. An equal number of girls and boys participated in the pilot study.

Measuring instruments

The measures used in the pilot study were selected based on the need to sample children's literacy, achievement in school, prosocial skills and receptive vocabulary (a measure of learning potential as well as verbal skills and emerging literacy); on their use with culturally distinct communities, including other AHS sites in Canada; and on budget.

Three standardized and norm-referenced measures were used: the Wechsler Individual Achievement Test (WIAT-II-A),[4] which assesses word reading, math calculation and spelling; the Social Skills Rating Scale (SSRS),[5] a rating scale tool used by teachers to identify prosocial behaviours and problem behaviours; and the Peabody Picture Vocabulary Test (PPVT-IV),[6] which assesses children's literacy potential through non-verbal measurement.

Design

Data collection was scheduled for three school days, February 26, 2008, through February 28, 2008. This timeline, chosen in cooperation with the school and the AHS coordinator, had few scheduling conflicts such as holidays or report card timelines.

School staff members were briefed about the pilot study and adjusted their class schedules to accommodate the 10 to 30 minutes that each participant student would be away from the class. A group of three to four students were taken from each classroom at a time; two would work with two researchers, while the other pair waited their turn. This format provided for efficient use of time with each researcher, as children would take different lengths of time to complete the tasks.

* Further information on the principles and values of community research can be found at http://www.communitybasedresearch.ca/Page/View/Principles

A classroom assistant helped with the continuous and smooth transition of participants from their classrooms to the data collection room, a practical and necessary part of the data collection procedures; a liaison person explained the procedure to the students to help them accept these, and assisted them as necessary; school administrative personnel confirmed receipt of parental consent forms and provided students' dates of birth for data analysis.

Child-friendly data collection methods (encouraging, fun, game-like) were used to maximize data collection and to make the experience non-threatening for the participants. The data were collected by researchers with applicable training and skill in the measurement tools. Further, the involvement and assistance of community members during data collection ensured that evaluation activities were culturally relevant and meaningful, and that they understood the process and methods, and could explain these should any questions arise.

Data analysis

The researchers ensured that data analysis adhered to the ethical and evaluative principles and sanctions of established evaluative and psychological governing bodies, such as the Canadian Evaluation Society and the Canadian Psychological Association.[†] Analysis included the use of the statistical software, Statistical Package for the Social Sciences (SPSS).[7] The statistical tests included a full range of descriptive statistics, sample size determinations, one-tailed t-tests to determine differences between groups, case-matched differences and one-tailed t-tests, ANOVA for grade differences, and two-tailed t-tests for gender and social skills differences. Qualitative data such as contextual factors, observations and process findings from the data collection were analyzed and summarized by the researchers.

Ethical considerations

A number of ethical considerations were of central importance throughout the pilot study. Participation was completely voluntary. All data collection activities required informed consent: parents/guardians were given a consent form to complete and had the right to refuse permission. Parents also had the opportunity to discuss any questions or concerns about the pilot study with school staff and the researchers. They could also seek out their individual child's results, which would be explained to them by the researchers. Confidentiality was maintained throughout, and the identities of the children were protected; participant results were not shared or even filed in school records. Group results were reported without revealing the identity of the participating children or their families.

Finally, the researchers integrated the OCAP[3] principles into the pilot study in order to ensure that the work was respectful and consistent with community values and traditions. Specific procedures in terms of de-briefing the staff of the pilot site, providing parents/guardians access to their child's results and ensuring the ownership of data were integrated in this project's methods. At the end of the pilot study, the researcher and her team provided a preliminary report of their findings to the site, the principal and the AHS coordinator. This ensured that results were given back to the local community for their use and for future program planning.

Results

Results of the pilot study were described in two main ways: the results of the outcome measures taken among children who had graduated from the Aboriginal Head Start program at the pilot site, and results pertaining to the feasibility of the methodology used and the feasibility for future longitudinal evaluation studies in Alberta.

The researchers found encouraging results in relation to the outcome measures completed among AHS graduates and observed that the AHS program is a highly beneficial intervention. Pilot study participants across all four grades scored in the average range (mean = 98.3) on the PPVT-IV, as compared to age-matched peers, indicating that the AHS children are performing as well as their age-equivalent peers on tasks that measure verbal abilities and language development (Table 1).

The pilot study participants scored in the average range on the WIAT-II-A for the three measures of academic skills, reading, numeracy and word writing (Table 2). The mean scores for all study participants across all four grade samples were within the average range compared to the norm-referenced group of age-matched peers (as outlined from the WIAT-II-A standardization sample of children), indicating that the AHS children are performing as well as their age-equivalent peers on academic tasks.

Performance across all grade levels in the AHS study pilot phase was at or above the average or expected range for language skills (receptive vocabulary) and school achievement. A series of analyses of variance (ANOVA) was performed for each of the achievement tests and the PPVT-IV. This analysis provided significant differences between groups on performance in WIAT-II-A word reading at different grade levels ($F(3,40) = 3.69$, $p < .05$, Cohen's $d = .44$). The Grade 5 and Grade 6 groups demonstrated stronger word reading skills than their younger counterparts, despite age-adjusted differences. The ECS class performed significantly lower on the word reading achievement test, compared to both the Grade 5 ($p = .007$) and grade 6 ($p = .02$) groups. The Grade 1 class showed a trend towards fewer word reading compared to Grade 5 ($p = .08$) and Grade 6 ($p = .09$). Despite these differences, the AHS children achieved equivalent or above average levels for the PPVT-IV and WIAT II-A, suggesting that these children are performing at or above their grade level (Figure 1).

Slight differences were found between the AHS and N-AHS participants in the pilot study, with the AHS group showing better performance on both word reading and math operations, though both the AHS and N-AHS participants displayed average scores on the PPVT-IV and WIAT-II-A, indicating

[†] More information on the Canadian Evaluation Society can be found at http://www.evaluationcanada.ca and on the Canadian Psychological Association at http://www.cpa.ca

TABLE 1
PPVT-IV scores from AHSUNC pilot – AHS students

Score obtained[a]	Grade				
	ECS (Kindergarten) n = 12	Grade 1 n = 8	Grade 5 n = 16	Grade 6 n = 8	Overall mean N = 44
Mean standard score[a] (SD)	97.3 (8.8)	96.3 (6.4)	99.7 (16.4)	98.8 (7.1)	98.3 (11.4)
Minimum standard score	80	89	77	80	80
Maximum standard score	109	108	133	110	133

Abbreviations: AHS, Aboriginal Head Start; AHSUNC, Aboriginal Head Start in Urban and Northern Communities; ECS, Early Childhood Services; PPVT-IV, Peabody Picture Vocabulary Test, 4th Edition; SD, standard deviation.

[a] The mean standard score is age-corrected. An above-average standard score is over 115; an average standard score is between 85 and 115; a below-average standard score is less than 70.

TABLE 2
WIAT-II-A[a] scores from AHSUNC pilot – AHS students

WIAT-II-A components	Early childhood services n = 12	Grade 1 n = 8	Grade 5 n = 16	Grade 6 n = 8	Overall mean N = 44
Word reading Mean standard score[a] (SD)	88.8 (10.7)	93.0 (4.5)	104.3 (19.8)	105.4 (12.1)	98.2 (15.7)
Numerical operations (math) Mean standard score[a] (SD)	101.3 (11.3)	102.0 (6.8)	97.7 (15.5)	89.6 (13.6)	98.2 (13.1)
Word writing (spelling) Mean standard score[a] (SD)	89.5 (8.5)	97.6 (15.0)	102.0 (18.7)	100.3 (10.9)	97.4 (15.03)

Abbreviations: see Table 1; WIAT-II-A, Weschler Individual Test, 2nd edition, abbreviated.

[a] The mean standard score is age-corrected. An above-average standard score is over 115; an average standard score is between 85 and 115; a below-average standard score is less than 70.

good language and academic achievement. To determine the difference between the small control sample of N-AHS students and the larger group of AHS children, we used a case-matched analysis. The four control N-AHS participants were matched with AHS participants in both age (within 3 months) and gender. Differences on one-tailed t-tests revealed no significant group differences on the PPVT-IV ($t(6) = .14$, $p = .45$, Cohen's $d = .10$); WIAT-Word ($t(6) = .45$, $p = .34$, Cohen's $d = .32$); WIAT-Math ($t(6) = .34$, $p = .37$, Cohen's $d = .24$) or the WIAT-Spell ($t(6) = .06$, $p = .48$, Cohen's $d = .04$). Figure 2 outlines the case-matched differences between AHS and N-AHS participants.

Discussion

Limitations

Key limitations of the pilot study included the small sample size and lack of pre-test (baseline) data. The small sample size was due to the rural, northern location of the pilot site. However, despite the small size, the overall sample was representative of both male and female students at different ages. The pilot study did not use a randomized group design so as to not exclude any students from participating in the pilot study. The lack of pre-test (baseline) data precluded analysis of the effect of the AHS program on the study participants. To date, there is no standardized process in place to collect ongoing baseline information among children who enter AAHS programs. It would be ideal to test participants prior to their entering and on their completing an AHS program.

Several other limitations were identified: there was no analysis of special needs children; there was no analysis of the community's socioeconomic demographics; the measures used were chosen in consideration of the needs of a culturally distinct sample; the measures used were abbreviated ones and were norm-referenced and standardized with North American children, which may or may not be representative of the pilot study sample. Also, when looking at the sample, children who participated in the pilot were essentially self-selected, i.e. those whose parents provided consent for their child to participate. These children may differ from those whose parents did not allow their children to participate.

Recommendations

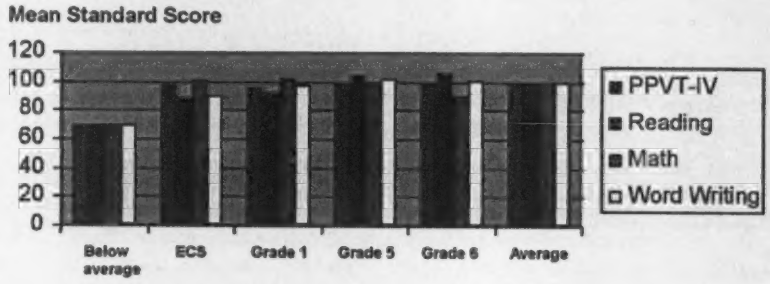
Despite these limitations, the researchers and AAHS Evaluation Subcommittee determined that there was potential for longitudinal studies and made the following recommendations to the AAHS Provincial Committee. First, baseline data collection should be collected from children before they start and then after they complete an AHS program, to help assess its effects. Further, standardized baseline data collection procedures should be integrated into current AHS site-level data and administrative reporting systems.

Second, the quality of the AHS program should be assessed as this can influence the graduates, and this is an important variable to measure in future evaluative studies.

Third, the workloads of AHS staff should be considered when planning for future studies. AHS program staff members implement daily and weekly program activities within full schedules, and future AHS evaluation studies need to consider realistic time commitments from program staff so as to not compromise AHS program operations.

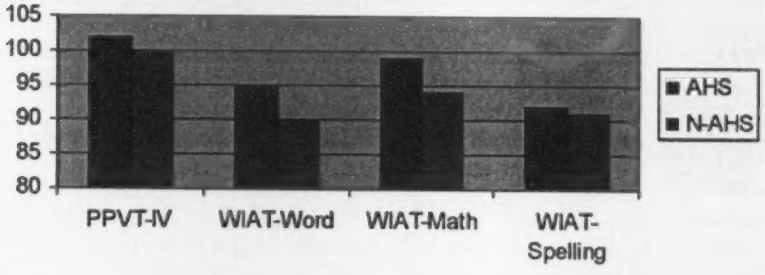
Fourth, sufficient lead time for evaluation planning, implementation and informed consent processes must be considered, as well as the resources required to assist

FIGURE 1
PPVT-IV and WIAT-II-A scores across grade levels from AHSUNC pilot – AHS students



Abbreviations: See Tables 1 and 2.

FIGURE 2
Case-matched differences of academic achievement and receptive vocabulary – AHSUNC longitudinal pilot study, Alberta (2008)



Abbreviations: See Tables 1 and 2; N-AHS, Non-Aboriginal Head Start.

with project liaison, scheduling, follow-up, administration, and any external challenges that arise. In some communities lead time may be as much as one year to allow for consultation with regional boards of education or other key stakeholders or administrators. Also, parents/guardians need to be briefed on the purpose, goals and procedures of the evaluation study in order to maximize understanding of the evaluation study.

Also recommended is a step-wise approach to the evaluation study: breaking down the longitudinal evaluation activities into different priorities each year may be a more practical and pragmatic way to accommodate budget and organizational capacity limitations of AHS sites. Further, program evaluation skills at the AHS sites should be developed. Finally, a greater and more varied sample of AHS sites in Alberta should be used to ensure a balance between urban and rural AHS programs.

Next steps

The results of the pilot study were discussed with the AAHS Provincial Committee (i.e. all Alberta AHS sites) and with regional Alberta PHAC staff at the June 2008 AAHS Provincial Committee meeting. All partners agreed that the results demonstrate potential for a full longitudinal program evaluation study of the AHS program in Alberta. There are considerations to be taken in planning a full study, as outlined in this article. Also critical is ongoing support from the Alberta AHS Provincial Committee and government partners to ensure an adequately resourced study over the next three to five years.

Conclusion

This pilot study demonstrated positive results for future studies. There are many program and evaluation strengths to build upon within AHS programs in Alberta, and these strengths can drive ongoing program development and outcome evaluation activities. Future studies in Alberta would help demonstrate the impact of AHS on children and the resulting impact on their health and well-being. Also important is the integration of the principles of community-based research into the evaluation of a community-based program such as AHS.

Acknowledgements

The opinions expressed in this article are those of the authors and do not necessarily reflect the opinions of the Public Health Agency of Canada. The authors would like to thank and acknowledge the following people: the teachers, parents and students who participated in the pilot study; Dr. Jennifer H. Chalmers, Dr. Marjan Saghatoleslami and Dr. Cheryl Bradbury for their expertise and the completion of this work; and the Alberta Aboriginal Head Start Evaluation Subcommittee for overseeing this project. We also thank Sarah Barber, Mary Jane Yates and Ann Pasquill for their comments on the manuscript. The project described in this article was done in collaboration between the Alberta Aboriginal Head Start Provincial Committee and the Public Health Agency of Canada, Alberta Region.

References

1. Canadian Institute for Health Information. Improving the health of Canadians. Ottawa (ON): Canadian Institute for Health Information; 2004.

2. Public Health Agency of Canada. Aboriginal Head Start in urban and northern communities (AHSUNC). An exploration of models of longitudinal and retrospective analysis. Edmonton (AB): Public Health Agency of Canada, Alberta Region; 2007.

3. First Nations Centre. OCAP: Ownership, control, access and possession [Internet]. Ottawa (ON): National Aboriginal Health Organization; 2007 [cited 2009 Oct 28]. Available from: http://www.naho.ca/firstnations/english/documents/FNC-OCAP_001.pdf

4. Wechsler, D. The Wechsler individual achievement test, 2nd edition abbreviated. San Antonio (TX): Pearson Education Inc.; 2001.

5. Gresham, FM, Elliot, SN. Social skills rating scale (SSRS) for elementary level teacher ratings. Toronto (ON): Pearson Canada Assessment Inc/NCS Pearson, Inc.; 1990.

6. Dunn, LM, Dunn DM. Peabody picture vocabulary test, 4th Edition. Toronto (ON): Pearson Canada Assessment Inc/NCS Pearson, Inc.; 2006.

7. SPSS for Windows Version 11. Chicago (IL): SPSS Inc.; 2001.

The comorbidity burden of the treated asthma patient population in British Columbia

R. Prosser, PhD (1); B. Carleton, PharmD (1); A. Smith, MSc (1)

Abstract

To date there has been little investigation of the prevalence of comorbid conditions in asthma patients. Using 1996/97 cross-sectional health services administrative data for British Columbia, we compared the prevalence of comorbid conditions in treated adult asthma patients with the general adult population using a standardized comorbidity identification methodology, the Adjusted Clinical Group (ACG) Case-Mix System. We also profiled the comorbidity burden of pediatric asthma patients.

Adults with asthma were significantly more likely to have a range of comorbidities, including respiratory infections, allergic rhinitis and 8 high impact/high prevalence chronic conditions (HIHPCCs). One in 4 adults with asthma had depression, the most prevalent HIHPCC. Children with asthma had a lower comorbidity burden than adults, but 12.6% had a stable or unstable chronic medical condition, with the most prevalent HIHPCC also depression.

Adults with asthma had a high and complex comorbidity burden, particularly in terms of multiple chronic conditions. We discuss the implications for services planning and delivery.

Keywords: *asthma, comorbidity, multimorbidity, burden of illness, population health, chronic conditions, British Columbia, Canada*

Introduction

Asthma is a chronic inflammatory disease of the respiratory system, and is one of the most prevalent chronic diseases, affecting an estimated 300 million people worldwide and creating a burden in the order of 15 million disability-adjusted life years lost annually—approximately the level for diabetes or schizophrenia. Prevalence appears to be increasing.[1]

In recent years there has been a growing recognition of the importance of addressing comorbidity in patients with chronic conditions. There are several reasons for this: co-occurrence of multiple chronic conditions is common;[2,3] comorbidity has a negative impact on patients' quality of life;[2,3] and chronic disease management patients with higher levels of comorbidity use more health care services than patients with lower levels.[4]

To date there have been few published studies of comorbidity in asthma patients, and the research has had limitations with respect to (a) the range of comorbid chronic conditions studied, (b) lack of consistency and of reported details of the definitions used for the comorbid conditions studied and (c) representativeness and/or size of the samples studied. The lack of uniformity and representativeness are important in relation to obtaining unbiased and precise estimates of the prevalences of conditions—especially less common conditions—and of co-occurrences of particular pairs of conditions.

Van Manen et al.[5] used a questionnaire to obtain data about 23 comorbid conditions from 290 general practice patients over the age of 40 with asthma and/or chronic obstructive pulmonary disease (COPD) and 421 control patients. Locomotive diseases, insomnia, stomach and duodenal ulcers, migraine, sinusitis, depression, cancer and atherosclerosis were significantly more prevalent in the former group.

Using data collected in an Australian general population health survey from 834 adults with asthma and 6609 without, Adams et al.[6] found that, after age and sex adjustments, arthritis, heart disease, stroke, cancer and osteoporosis were more prevalent among the asthmatic respondents.

Soriano et al.[7] estimated the prevalences of comorbid conditions—reported in terms of the major organ systems affected, e.g. gastrointestinal—and other types of disorders, e.g. infections, in an administrative data-based study in Britain involving 7933 patients with asthma and an equal number of matched controls without.

It is difficult to compare the results of these studies. Further, with the exception of a study by Diette et al.[8] concerning a few selected conditions in older asthma

Author References

1 University of British Columbia, Faculty of Pharmaceutical Sciences

Correspondence: Robert Prosser, 4th floor, Child and Family Research Institute, 950 West 28th Ave, Vancouver BC V5Z 4H4; Tel.: 604-875-2000 ext. 5360; Fax: 604-875-2494; E-mail: bprosser@popi.ubc.ca

patients and the van Manen et al. study,[5] there appears to have been little systematic analysis that describes prevalences of asthma patients' comorbidities in relation to age, sex and asthma severity.

In order to better design interventions and allocate health care resources, it is important for planners of chronic disease management programs to fully understand the needs of their target populations. Zhao et al.[9] recently proposed a methodology called disease burden profiling as a means of identifying and describing populations with chronic conditions. In this approach, prevalences for a wide range of comorbid condition categories are computed in a population with a particular index condition, and excess morbidity ratios are computed for these categories to compare prevalences for patients without the index condition. One key to the successful implementation of this approach is the categorization of the comorbidities in a standardized manner using case-mix software.

Starfield et al.[10] used the Johns Hopkins University Adjusted Clinical Group (ACG) Case-Mix System[11] as a standardized method to categorize comorbidity in a study of resource utilization by managed care organization patients with chronic conditions. For the index conditions studied—hypertension, asthma, diabetes and 8 others—patterns of use of physician and emergency room were highly related to the degree of comorbidity.

Broemeling et al.[12] also used this tool to categorize comorbidity in a population-based study of chronic conditions in British Columbia (BC). In 2000/01, 36% of the adult population had at least 1 chronic condition, and 30% of this group had 6 or more comorbid conditions. In comparison, 33% of the adult population had acute conditions only, and just 2.5% of this group had 6 or more comorbid conditions. Again, resource utilization was strongly linked to both the index conditions studied and patients' level of comorbidity.

The objective of this study is to compare the prevalences of common chronic and acute conditions in adults with asthma to prevalences in the province's general adult population using a standardized set of comorbidity identification algorithms—the ACG Case-Mix System.

Methods

Study design and data sources

We conducted a cross-sectional comparison of comorbidity prevalence in two populations: the population of treated adult (18 years and older) asthma patients in BC and the province's adult general medical services user population. The prevalence estimates used for the latter were obtained from a report by Reid et al.[13] on high-cost users of physician services in BC during the 1996/97 fiscal year that includes adult asthma patients.[13] In addition, we examined the prevalence of comorbidities in children with asthma aged 5 to 17 years and compared comorbidity profiles of subgroups within the adult and child populations.

The primary data sources used in this study were 3 linked BC Ministry of Health databases: the Medical Services Plan database containing fee-for-service general practitioner and specialist physician billing records, the Discharge Abstracts Database of hospital separation records and the PharmaNet database that captures all prescription drug dispensing in community pharmacies throughout BC.

The treated asthma population of BC

The treated asthma population in 1996/97, the year used by Reid et al.,[13] comprised 112 000 patients with continuous health care system enrolment aged 5 years or older between April 1, 1996, and March 31, 1997, who satisfied one or more of the following criteria during the year: (a) at least 3 dispensing events for asthma medications (the list of qualifying medications is available from the corresponding author); (b) at least one hospital discharge with International Classification of Diseases version 9 (ICD-9) code 493 as the principal diagnosis or (c) at least two 493-coded physician visits. In a previous validation study,[14] we estimated the sensitivity and specificity of our case definition to be 0.632 and 0.997, respectively, relative to a case selection algorithm developed using latent class modeling.

Data elements

Like Reid et al.,[13] we used the Johns Hopkins University ACG Case-Mix System (version 5) as a standardized, validated set of algorithms for creating a set of binary variables indicating the presence or absence of specific types of comorbidity. This system is extensively described in the reference manual for the software that is used to generate these variables from patients' physician visits and hospitalization records.[11] Recent validation studies in several jurisdictions—Sweden,[15] Spain[16,17] and two Canadian provinces[18]—have shown the system to be effective in characterizing the morbidity burden of populations.

Briefly, the system's set of 32 mutually exclusive Aggregated Diagnosis Groups (ADGs) form a high level classification scheme for groups of diseases/conditions. Each of the ICD diagnostic codes is assigned to a single ADG on the basis of 5 clinical dimensions of the condition: duration, severity, etiology, diagnostic certainty and the need for specialty care involvement. The conditions within an ADG are similar with respect to the expected level of resource utilization by patients. Having 1 or more of 8 major ADGs such as Chronic Medical: Unstable (ADG11) or Malignancy (ADG32), for example, is predictive, *ceteris paribus*, of greater resource use than having minor ADGs like Time-limited - Minor (ADG1) or Likely to Recur - Discrete (ADG7).

The system's 264 Expanded Diagnosis Cluster (EDC) variables represent sets of ICD diagnostic codes grouped on the basis of clinical similarity of the associated conditions. In contrast to ADGs, this grouping does not take into account possible differences in disease severity, chronicity or expected resource requirements. The EDCs, for example, Allergic Rhinitis (ALL03) or Ischemic Heart Disease (CAR03), are more useful than ADGs in identifying patients with particular comorbid conditions.

Table 1 provides the full names and abbreviations for the ADGs and EDCs we focused on in this study—40 of the 46 EDCs used by Reid et al.[13] The major ADGs are flagged. Note that several ADGs are omitted including ADG6 (Asthma), ADG31

TABLE 1
Aggregated Diagnosis Group (ADG) and Expanded Diagnosis Cluster (EDC) names and identifiers

	Aggregated Diagnosis Group (ADG)		Expanded Diagnosis Cluster (EDC)
1	Time limited: minor	ALL01	Allergic reactions
2	Time limited: minor – primary infections	ALL03	Allergic rhinitis
3	Time limited: major	CAR02[a]	Hypertension
4	Time limited: major – primary infections	CAR03[a]	Ischemic heart disease
5	Allergies	CAR05[a]	Congestive heart failure
7	Likely to recur: discrete	CAR09[a]	Cardiac arrhythmia
8	Likely to recur: discrete – infections	CAR10	Generalized atherosclerosis
9	Likely to recur: progressive	EAR01	Otitis media
10	Chronic medical: stable	EAR09	Chronic pharyngitis and tonsillitis
11	Chronic medical: unstable	EAR11[a]	Acute upper respiratory tract infection
12	Chronic specialty: stable – orthopedic	END01[a]	Diabetes mellitus
13	Chronic specialty: stable – ear, nose, throat	END02	Osteoporosis
14	Chronic specialty: stable – eye	END04	Thyroid disease
16	Chronic specialty: unstable – orthopedic	GAS02	Inflammatory bowel disease
17	Chronic specialty: unstable – ear, nose, throat	GAS05	Chronic liver disease
18	Chronic specialty: unstable – eye	GAS06[a]	Peptic ulcer disease
20	Dermatologic	GAS08	Gastroesophageal reflux
21	Injuries/adverse effects: minor	GAS09	Irritable bowel syndrome
22	Injuries/adverse effects: major	GSU11	Peripheral vascular disease
23	Psychosocial: time limited, minor	GUR08[a]	Urinary tract infection
24	Psychosocial: recurrent or persistent, stable	HEM02[a]	Iron deficiency, other deficiency anemias
25	Psychosocial: recurrent or persistent, unstable	INF01	Tuberculosis infection
26	Signs/symptoms: minor	MAL01	Malignant neoplasms of the skin
27	Signs/symptoms: uncertain	MAL02[ab]	Low impact malignant neoplasms
28	Signs/symptoms: major	MAL03[ab]	High impact malignant neoplasms
29	Discretionary	MUS03[a]	Degenerative joint disease
30	See and reassure	MUS14[a]	Low back pain
32	Malignancy	NUR01	Neurologic signs and symptoms
		NUR05[a]	Cerebrovascular disease
		NUR06	Parkinson's disease
		NUR08	Multiple sclerosis
		PSY01[a]	Depression, anxiety, neuroses
		PSY07[a]	Schizophrenia and affective psychoses
		REN01	Chronic renal failure
		RES02[a]	Acute lower respiratory tract infection
		RES03	Cystic fibrosis
		RES04[a]	Emphysema, chronic bronchitis, COPD
		RES07	Sinusitis
		RHU01[a]	Autoimmune and connective tissue diseases
		SKN02[a]	Dermatitis and eczema

Notes:
Shading indicates major ADGs and High Impact/High Prevalence (HI/HP) EDCs.

[a] EDCs for which comparisons are made with the general adult population. Asthma, our index condition, is also HI/HP.

[b] MAL02 and MAL03 are combined as Cancer when considering the HI/HP conditions.

(Preventive and Administrative), ADG33 (Pregnancy) and ADG34 (Dental). ADGs 15 and 19 are no longer used.

Statistical analyses

For each of 28 ADGs we computed the proportion of adult asthma patients who had the ADG and compared these odds with the corresponding odds for the general adult population. We repeated our profile comparison using the 21 EDCs and 19 additional EDCs (see Table 1). We obtained approximate 95% bootstrap confidence intervals[19] for each odds ratio (OR) using 1000 samples from the adult asthma patient population (n = 93 512). In computing the ORs we treated the odds values for the general population (computed from the Reid et al. proportions[13]) as exact estimates because of this population's large size (N = 2 521 248). Because comorbid conditions are interrelated and multiple comparisons of their prevalences are not independent, we used an adaptation of Westfall's multiple comparison method[20] to control type 1 error rate in testing composite hypotheses about intergroup ADG (EDC) profile differences. Using the age distribution reported by Reid et al.[13] for the adult service user (ASU) population and the age distribution for the adult asthma patient cohort, we created a set of weights that could be applied to the latter's data to perform a crude age adjustment in our OR comparisons of the asthma patient and ASU groups. We have reported weighted and unweighted comparisons.

We also created ADG and EDC prevalence profiles for male and female adults and children and compared the corresponding prevalences via ORs using bootstrapping to create confidence intervals, repeatedly sampling from each subgroup. We used SPSS version 15 for all our analyses.[21]

Results

Table 2 shows age and sex distributions for the adult asthma patient population and the general ASU population of BC. The latter comprises 84% of the province's total adult population. The percentages of asthma patients in the 60-to-74-year and 75-year -plus age groups are larger than the corresponding percentages for the ASU population. The proportion of men is similar for the adult asthma patient and ASU populations.

Table 3, which shows the prevalence of each ADG in the adult asthma patient and ASU populations, provides a summary of the 2 populations' comorbidity burdens. Adult asthma patients were significantly more likely to have any particular (ADG) category of comorbidity.

Table 3 also provides a comparison of the populations via ORs for the 28 ADGs. All but 2 of the ADGs had an OR, computed with weighting, that was significantly larger than 1, signifying a greater morbidity burden in the asthma population. Further, individual adults with asthma tended to have more multimorbidity than individual ASUs—larger numbers of ADGs, and in particular more of the 8 major ADGs (3, 4, 9, 11, 16, 22, 25 and 32) associated with very high expected resource use.[9] Of adult asthma patients, 36% had 6 or more ADGs, compared with 20% for ASUs; 18.9% of adult asthma patients had 2 or more major ADGs compared with 9.3% of ASUs.

While children with asthma generally had a lower comorbidity burden than adult asthma patients, 12.1% had 6 or more ADGs (14.8% for girls and 10.2% for boys); 12.6% had a stable or unstable chronic medical condition; and 4.3% had 2 or more major ADGs. The most prevalent ADG (65%) among these children was time-limited minor infections. Almost 1 in 6 children (15%) with asthma had allergies (ADG5), and 1 in 12 children—9.2% of girls and 6.9% of boys—had depression (PSY01). Note that ADG5 incorporates allergic rhinitis associated with a variety of factors, e.g. animal hair, but not conditions such as atopic dermatitis.

The most prevalent comorbidity among adult asthma patients was time-limited minor infections (ADG2): 56% had this ADG, an indicator of a variety of illnesses including acute bronchitis and acute upper respiratory tract infections (RTIs). A majority of adult asthma patients (59%) had either a chronic medical stable comorbid condition (ADG10) or a chronic medical unstable comorbidity (ADG11) or both. Examples of ADG10 conditions include essential hypertension, adult onset type 1

TABLE 2
Age and sex profiles of asthma patients and general adult service user (ASU) population

	Asthma patients		General adult
	All	Adults	service user population
	(n = 111 780)	(n = 93 512)	(N = 2 521 248)
Age (years)	%	%	%
5–11	10.3		
12–17	6.0		
18–29	9.8	11.7	20.0
30–44	17.4	20.8	32.0
45–59	17.4	20.8	23.4
60–74	23.2	27.7	15.8
75+	15.9	19.0	8.8
Total	100	100	100
	Patients aged 5–17	Patients aged 18+	Adult service users
Sex	%	%	%
M	57.7	43.5	45.6
F	42.3	56.5	54.4

TABLE 3
Prevalences and odds ratios for ADGs in adults with asthma and general adult service users

Aggregated Diagnosis Group (ADG)[a]		Prevalence per 1000 population		Unweighted[b]		Weighted[b]	
		Adults with asthma	General population users	Odds ratio	95% CI	Odds ratio	95% CI
27	Signs/symptoms: uncertain	486	400	1.42	(1.40, 1.44)	1.29	(1.27, 1.31)
28	Signs/symptoms: major	488	398	1.44	(1.42, 1.46)	1.36	(1.34, 1.38)
2	Time limited: minor – primary infections	561	359	2.29	(2.26, 2.31)	2.32	(2.28, 2.35)
26	Signs/symptoms: minor	497	309	2.21	(2.18, 2.24)	2.05	(2.02, 2.08)
10	Chronic medical: stable	437	282	1.98	(1.96, 2.01)	1.46	(1.44, 1.48)
1	Time limited: minor	324	276	1.26	(1.24, 1.28)	1.30	(1.28, 1.32)
7	Likely to recur: discrete	261	186	1.55	(1.52, 1.57)	1.48	(1.46, 1.51)
24	Psychosocial: recurrent or persistent, stable	231	170	1.46	(1.44, 1.49)	1.58	(1.56, 1.61)
21	Injuries/adverse effects: minor	174	150	1.19	(1.17, 1.21)	1.30	(1.28, 1.33)
11	Chronic medical: unstable	376	141	3.68	(3.63, 3.73)	2.44	(2.41, 2.48)
20	Dermatologic	140	125	1.14	(1.12, 1.16)	1.15	(1.12, 1.17)
8	Likely to recur: discrete – infections	170	121	1.49	(1.47, 1.52)	1.60	(1.57, 1.63)
29	Discretionary	164	118	1.46	(1.44, 1.49)	1.39	(1.37, 1.42)
22	Injuries/adverse effects: major	166	113	1.56	(1.53, 1.59)	1.56	(1.53, 1.59)
14	Chronic specialty: stable – eye	82	73	1.14	(1.12, 1.17)	0.73	(0.71, 0.75)
4	Time limited: major – primary infections	109	59	1.93	(1.89, 1.97)	1.74	(1.70, 1.78)
18	Chronic specialty: unstable – eye	68	59	1.17	(1.14, 1.20)	0.82	(0.80, 0.85)
3	Time limited: major	96	53	1.92	(1.88, 1.96)	1.50	(1.46, 1.53)
23	Psychosocial: time limited, minor	71	49	1.49	(1.45, 1.53)	1.60	(1.56, 1.65)
5	Allergies	102	47	2.29	(2.24, 2.34)	2.71	(2.65, 2.77)
32	Malignancy	71	34	2.18	(2.13, 2.24)	1.45	(1.41, 1.49)
25	Psychosocial: recurrent or persistent, unstable	50	31	1.66	(1.61, 1.71)	1.68	(1.62, 1.73)
9	Likely to recur: progressive	51	23	2.28	(2.22, 2.35)	1.44	(1.40, 1.49)
12	Chronic specialty: stable – orthopedic	27	21	1.29	(1.24, 1.35)	1.28	(1.22, 1.33)
13	Chronic specialty: stable – ear, nose, throat	24	14	1.70	(1.63, 1.77)	1.43	(1.36, 1.50)
16	Chronic specialty: unstable – orthopedic	20	14	1.40	(1.34, 1.47)	1.36	(1.30, 1.44)
30	See and reassure	20	14	1.45	(1.39, 1.51)	1.25	(1.19, 1.32)
17	Chronic specialty: unstable – ear, nose, throat	13	8	1.61	(1.52, 1.71)	1.38	(1.30, 1.48)

Notes:
Abbreviations: CI, confidence interval.

[a] The ADGs are in order of decreasing prevalence in the general adult service user population.

[b] In the unweighted computations, the asthma patients' age distribution is unmodified. In the weighted computations, cases were weighted to produce an age distribution that approximated that of the general adult service using population. Prevalences for adults with asthma are unweighted.

TABLE 4
Prevalences and odds ratios for EDCs in adults with asthma and general adult service user population

Expanded Diagnosis Cluster (EDC)[a]		Prevalence per 1000 population		Unweighted[b]		Weighted[b]	
		Asthma	General	Odds ratio	95% CI	Odds ratio	95% CI
EAR11	Acute upper respiratory tract infection	262	205	1.38	(1.36, 1.40)	1.60	(1.57, 1.62)
PSY01	Depression, anxiety, neuroses	249	187	1.44	(1.42, 1.46)	1.56	(1.54, 1.59)
NUR01	Neurologic signs and symptoms	225	175	1.37	(1.35, 1.39)	1.34	(1.32, 1.37)
RES02	Acute lower respiratory tract infection	354	115	4.23	(4.17, 4.29)	3.87	(3.81, 3.93)
CAR02	Hypertension	179	112	1.73	(1.70, 1.75)	1.16	(1.14, 1.18)
MUS14	Low back pain	137	106	1.34	(1.32, 1.37)	1.39	(1.37, 1.42)
SKN02	Dermatitis and eczema	77	58	1.35	(1.32, 1.38)	1.45	(1.41, 1.49)
GUR08	Urinary tract infection	82	56	1.51	(1.48, 1.55)	1.43	(1.38, 1.46)
CAR03	Ischemic heart disease	93	49	2.00	(1.95, 2.04)	1.22	(1.19, 1.25)
END01	Diabetes mellitus	67	41	1.68	(1.63, 1.72)	1.23	(1.19, 1.26)
MUS03	Degenerative joint disease	80	40	2.12	(2.07, 2.17)	1.49	(1.45, 1.52)
GAS06	Peptic ulcer disease	64	37	1.79	(1.75, 1.84)	1.66	(1.61, 1.71)
CAR09	Cardiac arrhythmia	58	27	2.24	(2.18, 2.30)	1.38	(1.34, 1.42)
MAL02	Low impact malignant neoplasms	49	24	2.08	(2.01, 2.14)	1.43	(1.38, 1.48)
HEM02	Iron deficiency, other deficiency anemias	38	19	2.07	(2.00, 2.14)	1.56	(1.50, 1.62)
RHU01	Autoimmune and connective tissue diseases	66	19	3.75	(3.65, 3.85)	3.13	(3.04, 3.22)
RES04	Emphysema, chronic bronchitis, Chronic Obstructive Pulmonary Disease (COPD)	197	16	14.75	(14.5, 15.0)	9.13	(8.96, 9.30)
CAR05	Congestive heart failure	61	14	4.62	(4.49, 4.74)	2.46	(2.39, 2.54)
PSY07	Schizophrenia and affective psychoses	20	13	1.50	(1.44, 1.57)	1.52	(1.45, 1.60)
NUR05	Cerebrovascular disease	25	12	2.23	(2.14, 2.33)	1.35	(1.29, 1.40)
MAL03	High impact malignant neoplasms	27	9	3.10	(2.97, 3.23)	2.21	(2.12, 2.31)

Notes:

[a] EDCs are listed in order of decreasing prevalence in the general adult service using population.

[b] In the unweighted computations, the asthma patients' age distribution is unmodified. In the weighted computations, cases were weighted to produce an age distribution that approximated that of the population of general adult service users. Prevalences for adults with asthma are unweighted.

diabetes and osteoarthritis; chronic liver disease, COPD and multiple sclerosis are examples of ADG11 conditions. The prevalences among adult asthma patients of ADGs 10 and 11 were 44% and 38%, respectively. One in 10 adult asthma patients had an allergy.

ADGs 2, 5 and 11 had the 3 largest ORs: 2.29 (95% CI = 2.26, 2.31); 2.29 (95% CI = 2.24, 2.34) and 3.68 (95% CI = 3.63, 3.73), respectively. The 28 ORs were recomputed after weights were applied to the adult asthma patient data to approximate the age distribution in the ASU population. The ORs changed, generally in the direction one would expect, but these 3 still had the largest ORs.

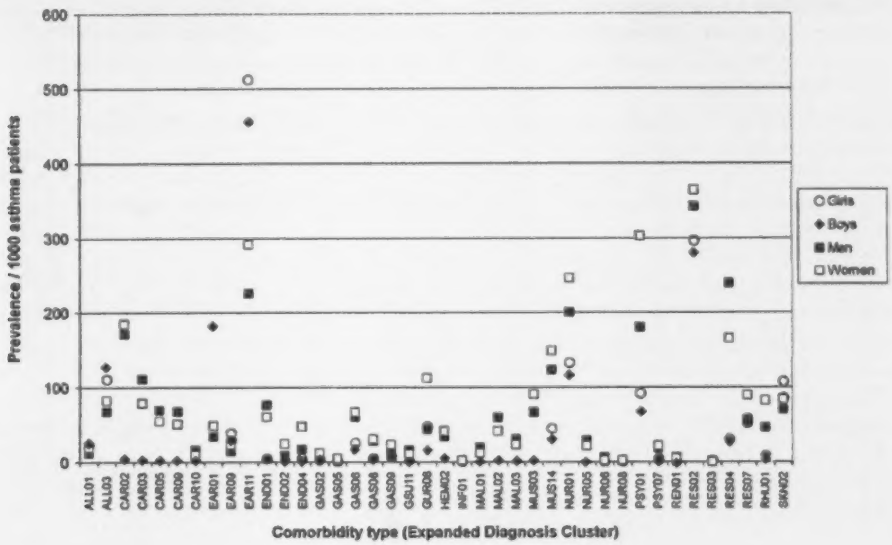
Table 4 shows the prevalences for 21 specific comorbid conditions—indicated by EDCs—in the adult asthma patient and ASU populations, and shows the ORs comparing the populations with respect to these EDCs. For each EDC the prevalence was higher for adult asthma patients than for ASUs. All 21 ORs were significantly larger than 1.

Among these 21 comorbidities are 10 that have been categorized by Broemeling et al.[12] as "high impact and/or high prevalence" chronic conditions (HIHPCCs). (Broemeling et al. also categorized asthma, our index condition, as an HIHPCC.[12]) The impact of each condition was assessed in terms of expected short-term resource use and outcomes. The HIHPCCs are depression, hypertension, diabetes, ischemic heart disease, degenerative joint disease, cardiac arrhythmia, cancer, congestive heart failure, cerebrovascular disease and COPD (including chronic bronchitis and emphysema). Note that in the interest of brevity we will use the term COPD to refer to the 3 conditions, recognizing that the "COPD" label is most applicable to patients 55 years of age or older.

Sixty percent of adult asthma patients had 1 or more additional HIHPCC, and 12% had 3 or more of these. One in 4 had depression and 1 in 6, hypertension. The prevalences of 3 of the HIHPCCs—high impact malignant neoplasms, congestive

FIGURE 1

Comorbidity (Expanded Diagnosis Cluster) prevalences for four age and sex groups of asthma patients[a] (1996/97)

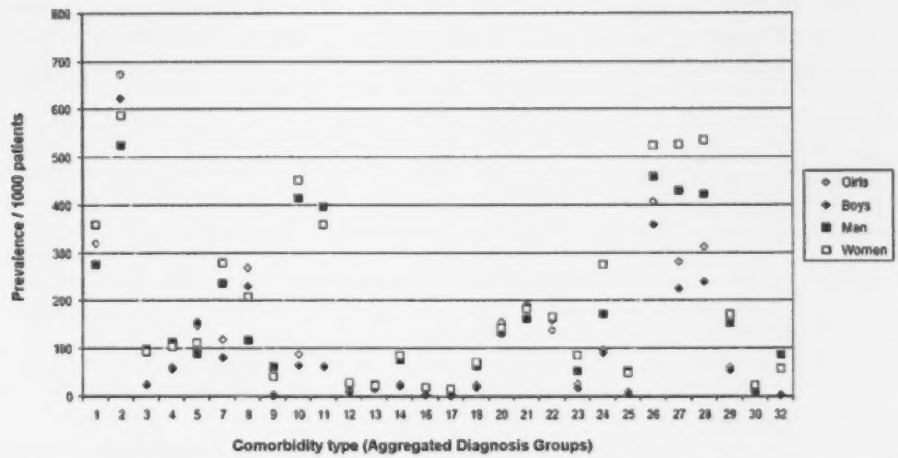

Prevalence / 1000 asthma patients
600
500
400
300
200
100
0
Girls
Boys
Men
Women
ALL01 ALL03 CAR02 CAR03 CAR05 CAR09 CAR10 EAR01 EAR09 EAR11 END01 END02 END04 GAS02 GAS05 GAS08 GAS08 GAS09 GSU11 GUR08 HEM02 INF01 MAL01 MAL02 MAL03 MUS03 MUS14 NUR01 NUR05 NUR06 NUR08 PSY01 PSY07 REN01 RES02 RES03 RES04 RES07 RHU01 SKN02
Comorbidity type (Expanded Diagnosis Cluster)

Note: Expanded Diagnosis Cluster labels are listed in Table 1.

[a] Girls and boys 5 to 17 years old, men and women 18 years old and over

FIGURE 2

Comorbidity (Aggregated Diagnosis Group) prevalences for four age and sex groups of asthma patients[a] (1996/97)



Note: Aggregated Diagnosis Group labels are listed in Table 1.

[a] Girls and boys 5 to 17 years old, men and women 18 years old and over

heart failure and COPD—were considerably higher (OR ≥ 2.0) in adult asthma patients than in ASUs. Adult asthma patients' odds of having depression were more than 50% higher than the odds for ASUs.

Of particular interest is the co-occurrence of additional chronic respiratory conditions in asthma patients. One in 5 adult asthma patients also had COPD, compared with 1.6% in the ASU population. Among asthma patients aged 56 and older, the proportion increased to 38% for men and 28% for women. The odds for adult asthma patients having COPD were 9.1 times larger than the odds for the ASU population. The ORs for acute lower and upper RTIs were 3.9 and 1.6, respectively.

Figures 1 and 2 show, respectively, the EDC and ADG profiles for male and female patients in the 5 to 17 years and 18 years and older age groups. The 4 EDC profiles were significantly different as were the 4 ADG profiles. Acute lower RTIs were the most prevalent comorbid condition for men and women and the second most prevalent for boys and girls, following acute upper RTIs. Otitis media was the third most prevalent condition in both boys and girls, while allergic rhinitis was fourth for boys and fifth for girls. COPD was more common in men than women, ranking second for men and sixth for women. Depression, anxiety and neuroses, however, were more prevalent in women, ranking second for women and fifth for men.

Discussion

The population of adult British Columbians with asthma has a higher overall illness burden than the province's general population of adult health care users. Each ADG category of comorbidity is significantly more prevalent in the asthma population. The proportion of the asthma population's members with 2 or more major ADGs is double the proportion of the general adult population. For each of 10 HIHPCCs, as well as 11 other specific comorbid conditions, the prevalence in adults with asthma was higher. This remains the case after adjusting for age differences in the two populations.

Although we expected to see a higher prevalence of allergies, acute respiratory conditions and COPD in the asthma population, we also found an increased prevalence for non-respiratory chronic conditions. In particular, we found that adult asthma patients have increased odds for having cancer, heart disease, stroke and arthritis. These findings have been reported by other investigators.[6] In contrast to Ben-Noun[22] and Adams et al.,[6] however, we found diabetes to be significantly more prevalent in the adult asthma patient population than in the general adult population.

Having multiple chronic conditions is common for adults in BC,[12] and this is particularly true for adult asthma patients where 1 in 8 had 3 or more HIHPCCs, increasing to 1 in 5 for adults 55 years and older. The most prevalent of the HIHPCCs in this multimorbidity subgroup were depression, hypertension, ischemic heart disease and COPD.

As Broemeling et al.[12] point out, it is important to consider both impact and prevalence of comorbid chronic conditions in analyzing the health care needs of the asthma patient population. While it may be tempting to enhance patient care by focusing on treatment of asthma patients' depression because it is common, chronic conditions like COPD have a higher impact, in terms of health service utilization, albeit for a smaller proportion of asthma patients.

In contrast, and as expected, children with asthma are relatively free of major comorbidities. Fewer than 1 in 4 has any major ADGs and only 12% have 1 or more HIHPCCs. The most prevalent major comorbidity category is major injuries/adverse effects, and the most prevalent HIHPCC is depression.

The BC population of asthma patients is very heterogeneous, and many patients have complex treatment and self-management needs. As Adams et al.[6] point out, age needs to be considered in planning care for patient subgroups: comorbidity profiles of children and older and younger adult populations differ considerably. We have also found that asthma patients of a particular age and sex can differ considerably in terms of their comorbidity profiles.

The literature and clinical practice guidelines tend to portray asthma patients as if they only had asthma. Knowing comorbidity prevalences for this (or any other condition-based) population and the similarities and differences in service needs of patient subgroups can help health system planners make more rational allocations of resources,[23] and can enable clinicians, particularly those in primary care, to consider and develop holistic approaches to treatment. Chronic disease management strategies that are suitable for patients with a single chronic disease will need to be adapted for patients with multiple, possibly unrelated, chronic conditions. Self-management approaches that are more generic, such as those developed by Lorig et al.,[24] may serve as a model.

Patients with multimorbidity face numerous barriers to following complex disease management plans,[25] and some combinations of conditions make this particularly difficult. Increasing exercise might be an appropriate goal for an obese patient with diabetes, for example, but having asthma and arthritis as well might make this difficult to accomplish.[26] Having depression, as 25% of adult BC asthma patients do, makes it difficult to maintain motivation to follow a treatment plan.[27]

We have compared two populations with respect to the prevalences of common acute and chronic conditions—a complete provincial population of adults with treated asthma and the province's general adult health service using population—using a standardized set of comorbidity identification algorithms. We have described the nature of the higher comorbidity burden of the asthma patient population. A variety of associations, between asthma and other respiratory and atopic conditions—links that clinicians and physiologists are familiar with—have been supported and given precise estimates at a population level.

In addition, we have compared the comorbidity prevalence profiles of male and female adults and children. These comparisons are possible because of the comprehensiveness of service use data from a large universal public health care system. In contrast to several other studies that have used small sample surveys and non-standard methods to identify comorbid conditions, the methodology of our study could be used to make precise comparisons of asthma patients' comorbidity profiles between jurisdictions that have population-based administrative data.

Several limitations of our study are a result of data access issues. Individual level data for the general adult population were not available to us: we relied on 1996/97 aggregated data reported by Reid et al.[13] making it possible to perform a simple age-related weighting adjustment to adult asthma patients' data in computing ORs but not to match asthma patients

to individuals without asthma by age and sex—a preferable approach that would reduce underestimation of associations. Further, we did not have access to general population children's data, precluding the type of comparisons we made for adults. Population comparisons based on more recent data, were we able to make them, could show different results. A comparison of adult asthma patients' comorbidity profiles across 5 years (results not shown) suggests that for the majority of conditions we examined, prevalence increased.

We recognize that we are really estimating prevalences of treated comorbidities. Patients with mild conditions for which they seldom if ever use physician or hospital services would not be counted as having the comorbidity. On the other hand, because the primary focus in health care planning is usually on users of the health care system, especially frequent or high-cost users, our current results are very relevant.

The case definition we used to identify asthma patients is similar to the one used by the BC Ministry of Health for surveillance purposes.[28] Using a definition with a higher sensitivity—a more inclusive definition would probably create a more heterogeneous cohort—could have the effect of lowering the odds ratios we observed. In older patients it is often difficult to distinguish COPD from asthma because the two conditions share several clinical features including the symptoms of dyspnea, cough, wheezing and sputum production. If some asthma patients identified by the ACG algorithm as having COPD were false positives, the effect would be to lower the apparent prevalence of COPD in these patients.

In summary, our current research suggests that treated adult asthma patients have a significantly greater comorbidity burden than adults in the general population, both in terms of number of comorbid conditions and in terms of occurrence of specific conditions. While higher prevalences of additional respiratory and atopic conditions are expected, the higher prevalences of conditions like cancer are less so. These latter associations may provide a starting point for further clinical research.

References

1. Masoli M, Fabian D, Holt S, Beasley, R. The global burden of asthma: executive summary of the GINA Dissemination Committee report. Allergy. 2004;59(5):469-78.
2. Fortin M, Lapointe L, Hudson C, Vanasse A, Ntetu AL, Maltais D. Multimorbidity and quality of life in primary care: a systematic review. Health Qual Life Outcomes. 2004; 2:51.
3. Sprangers MA, de Regt EB, Andries F, van Agt HM, Bijl RV, de Boer JB, Foets M, Hoeymans N, Jacobs AE, Kempen GI, Miedema HS, Tijhuis MA, de Haes HC. Which chronic conditions are associated with better or poorer quality of life? J Clin Epidemiol. 2000; 53(9):895-907.
4. Charlson M, Charlson R, Briggs W, Hollenberg J. Can disease management target patients most likely to generate high costs? The impact of comorbidity. J Gen Intern Med. 2007;22(4):464-9.
5. van Manen JG, Bindels PJ, Ijzermans CJ, van der Zee JS, Bottema BJ, Schadé E. Prevalence of comorbidity in patients with chronic airway obstruction and controls over the age of 40. J Clin Epidemiol. 2001;54(3):287-93.
6. Adams RJ, Wilson DH, Taylor AW, Tursan d'Espaignet E, Dal Grande E, Ruffin RE. Coexistent chronic conditions and asthma quality of life: a population-based study. Chest. 2006;129(2):285-91.
7. Soriano JB, Visick GT, Muellerova H, Payvandi N, Hansell AL. Patterns of comorbidities in newly diagnosed COPD and asthma in primary care. Chest. 2005; 128(4):2099-107.
8. Diette GB, Krishnan JA, Dominici F, Haponik E, Skinner EA, Steinwachs D, Wu AW. Asthma in older patients: factors associated with hospitalization. Arch Intern Med. 2002;162(10):1123-32.
9. Zhao Y, Ash AS, Ellis RP, Slaughter JP. Disease burden profiles: an emerging tool for managing managed care. Health Care Manage Sci. 2002;5(3):211-9.
10. Starfield B, Lemke KW, Bernhardt T, Foldes SS, Forrest CB, Weiner JP. Comorbidity: implications for the importance of primary care in 'case' management. Ann Fam Med. 2003;1(1):8-14.
11. Weiner J, Abrams C. ACG software documentation/users manual, version 5.0. Baltimore (MD): John Hopkins Bloomberg School of Public Health:2001.
12. Broemeling A M, Watson DE, Black C. Chronic conditions and co-morbidity among residents of British Columbia. Vancouver (BC): UBC Centre for Health Services and Policy Research, University of British Columbia; 2005.
13. Reid R, Evans R, Barer M, Sheps S, Kerluke K, McGrail K, Hertzman C, Pagliccia N. Conspicuous consumption: characterizing high users of physician services in one Canadian province. J Health Serv Res Policy. 2003;8(4):215-24.
14. Prosser RJ, Carleton BC, Smith MA. Identifying persons with treated asthma using administrative data via latent class modelling. Health Serv Res. 2008; 43(2):733-54.
15. Carlsson L. Patient based 'burden-of-illness' in Swedish primary health care. Applying the Johns Hopkins ACG case-mix system in a retrospective study of electronic patient records. Int J Health Plann Manage. 2002;17(3):268-82.
16. Juncosa S, Bolibar B, Roset M, Tomas R. Performance of an ambulatory casemix measurement system in primary care in Spain: ambulatory care groups (ACGs). Eur J Public Health. 1999;9(1):27-35.

17. Orueta JF, Lopez-De-Munain J, Báez K, Aiarzaguena JM, Aranguren JI, Pedrero E. Application of the ambulatory care groups in the primary care of a European national health care system: does it work? Med Care. 1999;37(3):238-48.

18. Reid RJ, MacWilliam L, Verhulst L, Roos N, Atkinson M. Performance of the ACG case-mix system in two Canadian provinces. Med Care. 2001;39(1):86-99.

19. Davison AC, Hinkley DV. Bootstrap methods and their application. Cambridge (UK): Cambridge University Press; 1997.

20. Westfall P. Simultaneous small-sample multivariate Bernoulli confidence intervals. Biometrics. 1985;41(4):1001-13.

21. SPSS Inc. SPSS 15.0 Command Syntax Reference. Chicago (IL): SPSS Inc.; 2006.

22. Ben-Noun L. Characteristics of comorbidity in adult asthma. Public Health Rev. 2001; 29(1):49-61.

23. Fleming DM, Pannell RS, Elliot AJ, Cross KW. Respiratory illness associated with influenza and respiratory syncytial virus infection. Arch Dis Child. 2005;90:741-6.

24. Lorig K, Ritter P, Stewart A, Sobel D, Brown B, Bandura A, Gonzalez VM, Laurent DD, Holman HR. Chronic disease self-management program: 2-year health status and health care utilization outcomes. Medical Care. 2001;39:1217-23.

25. Bayliss EA, Steiner JF, Fernald DH, Crane LA, Main DS. Descriptions of barriers to self-care by persons with comorbid chronic diseases. Ann Fam Med. 2003; 1(1):15-21.

26. Grumbach K. Chronic illness, comorbidities, and the need for medical generalism. Ann Fam Med. 2003;1(1):4-7.

27. Smith A, Krishnan JA, Bilderback A, Reikert KA, Rand CS, Bartlett SJ. Depressive symptoms and adherence to asthma therapy after hospital discharge. Chest. 2006;130(4):1034-38.

28. Asthma in British Columbia—an administrative data view [Internet]. Victoria (BC):British Columbia Health Services; 2004 May [cited 2009 May 5]. Available from: http://www.health.gov.bc.ca/cdm/research/asthmadataview.pdf

Gender, social relationships and depressive disorders in adults aged 65 and over in Quebec

S.-D. Mechakra-Tahiri, PhD (1,2); M. V. Zunzunegui, PhD (1,2); M. Préville, PhD (3); M. Dubé, PhD (4)

Abstract

The objective of this study was to examine if social relationships have a differential association with the presence of depression in men and women aged 65 and over. Data came from a survey of a representative sample of 2670 community-dwelling older adults in Quebec. Depressive disorders were measured using DSM-IV criteria. The prevalence of depression was 17.8% for women and 7.6% for men. Men reported a greater diversity of ties but less support than women. Having a confidant and/or being engaged in a good marital relationship was negatively associated with depression in both men and women. Compared with married people in general, widowhood was associated with a considerably higher risk of depression in men than in women. Compared with non-volunteers in general, men who volunteer were at considerably lower risk of depression than women who volunteer. This exploratory study could serve as a basis for future longitudinal studies on the impact of community activities and volunteering on the incidence and remission of depression in older men and women in Canada.

Keywords: *gender, depression, social networks, volunteerism, widowhood, elderly, Quebec, older adults, conflict*

Introduction

Epidemiological studies agree that women present more depressive disorders than men, with a gender prevalence ratio between 1.5 and 2.[1-7] In Canada, the prevalence of depression varies depending on the measuring instrument and diagnostic criteria used.[8-10] According to Ostbye et al.[9] in the population aged 65 and over, the prevalence of depression (diagnosed using DSM-III-R* criteria) was 9.3% in women and 2.9% in men; of major depression was 3.4% for women and 1.5% for men, and of minor depression was 6.0% for women and 1.4% for men. Risk of depression has been associated with lack of social networks and support,[6,11,12] and differences in the social networks of men and women have been documented.[13] Thus, gender differences in depression could be at least partly explained by differences in the social relationships of men and women. Few studies have looked at the differential association between social relationships and depression in older populations, and their results are limited to some specific aspects of relationships, such as marital status or social support. According to some researchers, widowhood is associated with increased depressive symptomatology for both men and women[13] and marriage appears to be more beneficial for men's mental health.[3,5,14] However, according to another study,[15] the effect of marital status on mental health varies depending on the region or society in which the study was done. With respect to the influence of others, studies have looked mainly at the role played by offspring or friends in depression, and again, the results vary with the context of the study.[13,16] Some European studies reported that the contacts of offspring with elderly parents had a protective function,[13,17,18] while in a study conducted in the United States, the support provided by offspring was found to be important mainly if the older adults were in a situation where they needed help (i.e. poverty, poor health or widowhood).[19]

The association between social integration and depressive symptoms was reported by cross-sectional and longitudinal studies conducted in the elderly.[11,20-23] However, in these studies the differential effect of friends' support or social integration on mental health were not examined separately by gender.

Studies show that social support provided by the members of social networks is inversely associated with depression in older men,[3] and that the presence of conflictual relationships is related to depression for both women and men.[13] In other research, however, the association of conflictual relationships is stronger in women.[24] In Canada, one study examined

* Diagnostic and Statistical Manual of Mental Disorders, Third Edition, Revised

Author References

1 Department of Social and Preventive Medicine, Université de Montréal, Montréal, QC
2 Institut de recherche en santé publique de l'Université de Montréal, Montréal, QC
3 Department of Community Health, Université de Sherbrooke, Sherbrooke, QC
4 Laboratory of Gerontology, Department of Psychology, Université du Québec à Trois-Rivières, Trois-Rivières, QC
Correspondence: Samia-Djemaa Mechakra-Tahiri, PhD, 911 Avenue Antonine Maillet, Outremont, QC H2V 2Y8, Tel.: 514-277-4688, E-mail: samiatahiri@yahoo.fr

the association between social relationships and the presence of psychological distress and depression in older adults[25] and showed that even though women receive more support than men, there are no gender differences in the impact of support on these.

In this study, we examined the association between depression in adults aged 65 and over and several structural aspects of social relationships such as marital status, relationships with family and friends and memberships in clubs, other groups and leisure organizations. We further contribute to the literature by examining the associations between depression and functional aspects of social relationships, such as support and conflict. Lastly, we examine if these associations differ between older men and older women.

Methods

Study population and data collection

Data used in this study came from the "Enquête sur la Santé des Aînés" (ESA), a cross-sectional survey conducted in 2005-2006 using a representative sample of French-speaking, community-dwelling adults over the age of 65 (94% of the Quebec population speaks French). A proportional sample of households was constituted according to the 16 administrative regions of Quebec and a random sampling method was used to select no more than one adult aged 65 years or over per household.[26,27] Subjects who obtained a score of less than 22 on the Mini-mental State Examination (MMSE) were excluded because they could have presented a cognitive deficit[28] that compromised the validity of their responses to the ESA questionnaire. The response rate was 66.5%. Data were collected through at-home, face-to-face interviews. Details on data collection procedures are given in a previous publication.[27] The research procedure was reviewed and approved by the Ethics Committee of the Sherbrooke Geriatric University Institute.

Measures

Dependent variables: depressive disorders

The respondents' depression status (including major and minor depression) was measured using the computer-based ESA-Q developed by members of the research team[27] and based on criteria in the DSM-IV.[†] The ESA-Q is similar to the Diagnostic Interview Schedule (DIS)[29] and the Composite International Diagnostic Interview (CIDI),[30] which demonstrated satisfactory reliability and validity.[29-31]

A 12-month recall period was used. Subjects were classified as major depression cases if they displayed the essential features of depression (i.e. either depressed mood or the loss of interest or pleasure in usual daily activities, and reporting at least five of the nine symptoms associated with depression) nearly every day and most of the day for at least two consecutive weeks. In addition, subjects who displayed the essential features of depression and reported between two to four of the nine associated symptoms of depression within the same time period were classified as minor depression cases. For the purpose of this study, the definition of depression did not include impairment of respondents' usual social functioning. Participants whose symptoms were related to a physical illness or treatment were not classified as cases of major or minor depression. For the purpose of this study, and in agreement with our previous research,[27] a dichotomous outcome was defined as 1 if the person fulfilled the criteria for major or minor depression and 0 if otherwise.

Independent variables: social relationships

The structural and functional characteristics of the respondents' social relationships were measured using four variables: social network, social integration, social support and conflictual relationships.

The social network was measured using two indicators: diversity of social ties and marital status.[32,33] Diversity of social ties was measured by the number of different types of relationships that participants had, including those with a partner, adult children, siblings, friends and members of a community group.[33] This variable was rated on a scale of 0 to 5 and recoded into three categories: low (0 to 2 relationships), medium (3 to 4 relationships) and high (5 relationships). Marital status was divided into four categories: with partner, separated or divorced, widowed, and never married. Social integration was measured using three questions related to participation in the community: 1) Do you regularly go to leisure, cultural or social centres? 2) Do you regularly do volunteer work? 3) Do you regularly attend religious services (at a church, synagogue, mosque or other centre of worship)?

Social support[34] was measured using three questions about the availability of a confidant to talk to about various problems, the presence of someone who could provide instrumental help and the presence of someone who could provide emotional support.

Conflictual relationships were measured using five questions, three of which concerned feeling criticized or disapproved of by adult children, siblings and/or friends.[13,24] Each was evaluated on a scale of 0 to 4. Those who answered never (0) or rarely (1) were considered not to have any conflictual relationships, while those who answered sometimes (2), often (3) or always (4) were considered to have conflictual relationships with family or friends. For the analysis, those with conflict in their relationships with adult children (2 to 4) and those without conflict in these relationships (0 to 1) were compared with those without children (the reference category).

The remaining two questions concerned conflicts in the relationship with one's partner and evaluated the frequency with which the person argued with him or her as follows: 1) How often do you argue with your partner? and 2) How often do you and your partner get on each other's nerves? Each variable was measured on a scale from 0 (never) to 5 (always) to classify frequency of quarrelling. A single variable summing the responses to these

[†] Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.

two questions was created and divided into three categories: no partner, no conflict (rarely or never) and conflicts (sometimes or more often). Again those without a spouse were taken as the reference category to examine if the presence of conflict changes the association between depression and the fact of being married.

The following risk factors for depression, as identified in the literature, were considered in the analysis due to their possible confounding role: age, gender, region of residence, family annual income and health status.

Region of residence was divided into urban, metropolitan and rural, as defined by the Institut de la statistique du Québec.[35] According to the Institute, the only metropolitan region in Quebec is the city of Montréal; an urban area is one with at least 1000 inhabitants and a population density of at least 400 inhabitants per square kilometre; and all other regions are classified as rural.

Family annual income was divided into four categories: less than $15,000, between $15,000 and $25,000, between $25,001 and $35,000, and over $35,000.

Health status was measured using two indicators: self-perceived physical health and morbidity. Perceived physical health was evaluated with the question: In general, compared to other people your age, would you say your physical health is excellent, very good, good, fair or poor? Morbidity was measured by the number of the participant's chronic health problems (defined in the ICD-10[‡]), which was divided into four categories: 0, 1 to 2, 3 to 4, and 5 or more chronic health problems. Chronic conditions were evaluated with the following question: To your knowledge and under the advice of a doctor, do you currently have one of the following diseases: heart disease, disorders of the digestive and endocrine systems, and/or 15 other conditions.[§]

Statistical analyses

A descriptive analysis of the socio-demographic characteristics and social relationships was done separately for the male and female participants, and the differences in the distributions were examined using the chi-square test. Confounding variables associated with depression in the bivariate analyses with ($p < .25$) were considered in the subsequent multivariate analyses.[36]

Simple binary logistic regression models, done separately for men and women, were used to examine the associations between social relationships and the presence of a depressive disorder and to estimate the odds ratios (OR) with 95% confidence intervals (CI). The confounding variables were included in two blocks. The first included socio-demographic factors and the second, physical health. Staggered entry was used to assess the changes in the coefficients of the associations between depressive disorders and social relationships after adjusting first for socio-demographic variables and second for physical health.

Interaction terms of each variable of social relationships with gender were tested one-by-one in a series of logistic regression models fitted to the whole sample (men and women) and controlling for all confounders. Lastly, a final model including all significant interactions and confounders was fitted. Odds ratios were estimated with their 95% confidence intervals. All the analyses were done with SPSS version 15 for Windows.[¨]

Results

For this study we used the 2670 individuals with complete data on all the variables in the analyses. The 132 individuals for whom at least one item of information was missing differed from those with complete data on marital status (more were married: 70.8%, $p < .001$) and gender (more men [58.3%] than women [41.7%]; $p < .001$). No significant difference was found for the remaining socio-demographic and health characteristics.

Table 1 shows that the female participants in our study had higher exposure to those factors commonly associated with depression:[2] they were older, had less schooling, were poorer, had more chronic health problems and were in poorer health than the male participants. They also had significantly higher prevalence of depression than men. The prevalence of depressive disorders (including major and minor depression) was 17.8% for women and 7.6% for men. For major depression, the prevalence was 5.3% for women and 2.6% for men; for minor depression, it was 12.5% for women and 5.0% for men.

As shown in Table 2, a higher proportion of men than women lived with a partner (57.2% vs. 36.6%, $p < .001$) and twice as many of the women were widowed (42.7% vs. 20.0%, $p < .001$). A high proportion of both men (87.5%) and women (89.5%) reported having friends; 86% reported having children and 90%, siblings. No significant difference with regards to the distributions of having friends, children or siblings was found between men and women. In addition, the results (Table 2) show that men reported a greater diversity of ties than did women ($p < .001$), while a greater proportion of women went to social centres ($p = .008$) and attended religious services ($p < .001$). One-third of both men and women reported being involved in volunteer work. A greater proportion of women than men reported having a confidant (88.7% vs. 85.4%, $p < .012$).

Of the married respondents, men reported fewer conflictual relationships with their spouse (70.7 vs. 79.2%, $p < .001$).

Table 3 shows the associations between depression and social relationships, first adjusting for socio-economic factors and

‡ International Statistical Classification of Diseases and Related Health Problems, 10th Revision.

§ high blood pressure; hypercholesterolemia; diabetes mellitus; anaemia; B12 deficiency; asthma; chronic bronchitis; liver disease; kidney disease; skin disease; eye disease; arthritis; chronic back pain; headache; schizophrenia

¨ Statistical Package for the Social Sciences: http://www.spss.com/

TABLE 1
Distribution of socio-demographic characteristics and health status in women and men aged 65 and over in Quebec (N = 2670)

Variables	Men (n = 1073) %	Women (n = 1597) %	p (χ2)
Age (years)			< .001
65-69	33.7	28.8	
70-74	29.2	24.9	
75-79	21.5	21.5	
80-84	12.6	18.0	
85+	3.0	6.7	
Schooling			< .001
Elementary or less	65.6	68.6	
Secondary	16.1	20.0	
Post-secondary and college	18.3	11.3	
Income			< .001
< $15,000	9.1	22.6	
$15,000-$25,000	18.8	28.3	
$25,001-$35,000	21.5	25.1	
> $35,000	50.6	24.1	
Area			.11
Urban	15.5	17.3	
Metropolitan	43.6	45.6	
Rural	40.9	37.0	
Chronic health problems (#)			< .001
0	10.2	6.1	
1-2	35.3	31.0	
3-4	33.2	34.4	
5 or more	21.2	28.6	
Perceived physical health			.004
Excellent	22.4	17.1	
Very good	33.8	34.6	
Good	30.3	31.1	
Fair	11.9	15.0	
Poor	1.6	2.2	
Depression			< .001
Major	2.6	5.3	
Minor	5.0	12.5	
Combined	7.6	17.8	

Abbreviations: χ2, chi-square test; <, less then; n, sample size; N, overall sample size; %, percent; *p*, p-value.

second adjusting for physical health. Being widowed, going less to social centres, and not volunteering were significantly associated with the probability of presenting a depressive disorder in older men but not in women. Lack of instrumental support lost significance in the fully adjusted model (OR = 2.33; 95%CI 0.99, 5.46). While our results show that men involved in volunteer work had lower frequency of depressive disorders, this association was not significant in women. No statistically significant associations were found between depressive disorders and diversity of ties or attending religious services in either men or women.

With regards to social support, lack of instrumental support[††] in men and lack of emotional support in women were associated with increased likelihood of presenting a depressive disorder. Unavailability of a confidant was associated with depression in both men and women.

Finally, the presence of conflictual relationships with friends, offspring and siblings was not associated with depression in men or women while nonconflictual relationships with one's partner was associated with decreased probability of reporting a depressive disorder in both men and women (Table 3). Nevertheless, among men marriage was associated with less depression, even in the presence of marital conflict. Among women marriage was associated with low likelihood of depression only when there was no conflict in the marital relationship.

Controlling for health indicators did not substantially change the odds ratios except for the attenuation of the association between lack of instrumental support and depression in men and lack of emotional support and depression in women (Table 3).

Introduction of multiplicative terms to test for gender interactions revealed two differential and significant associations: between marital status and depression and between volunteering and depression (Table 4). Widowhood is more strongly associated with depression in men than in women: a widowed man is 2.85 times more likely to be depressed than a married man, while a widowed woman is only 1.35 times (3.34/2.47) more likely to be depressed than a married woman. Differential effects of separation/divorce and of never-married status are much smaller.

Volunteering may be more beneficial to men (odds ratio for depression 0.43 compared to non-volunteers) than to women (odds ratio = 0.89).

[††] Instrumental support: presence of someone who could provide practical help.

TABLE 2
Distribution of social relationships in women and men aged 65 and over in Quebec (N = 2670)

Variables	Men (n = 1073) %	Women (n = 1597) %	p (χ2)
Social Networks			
Marital status			< .001
With partner	57.2	36.6	
Separated or divorced	15.5	12.0	
Widowed	20.0	42.7	
Never married	7.4	8.8	
Children			.89
Yes	86.4	86.6	
No	13.6	13.4	
Siblings			.49
Yes	91.0	90.2	
No	9.0	9.8	
Friends			.10
Yes	87.5	89.5	
No	12.5	10.5	
Diversity of ties			< .001
Low (0-2 relationships)	13.5	18.0	
Medium (3-4 relationships)	64.1	72.6	
High (5 relationships)	22.3	9.4	
Social integration			
Visit social centres			.008
Yes	39.5	44.6	
No	60.5	55.4	
Volunteering			.27
Yes	34.5	32.4	
No	65.5	67.6	
Attending religious services			< .001
Yes	44.4	55.5	
No	55.6	44.5	

Discussion

The objective of this study was to examine if social relationships were associated with the probability of presenting a depressive disorder in women and men aged 65 and over. Our results showed that marital status, being socially active and doing volunteer work were strongly inversely associated with the presence of depression only in older men. Women were more depressed than men generally, except widowers.

Our study did not find any association between relationships with adult children, siblings and friends and depression in older men and women in Quebec. This result is different from those reported in some studies that showed that offspring were salient for older adults' mental health,[17,18,37] or others that reported the beneficial effect of friends on older adults' well-being.[12,13,16] In the United States, Silverstein et al. showed that support from adult children was important for older adults only if they were in a situation where they needed help (in poor health or widowed). However, we could not compare our results with those reported in these studies because they did not examine gender differences.

To reiterate, according to our results offspring do not seem to play an important role in depression among adults over 65 years old in Quebec. Maybe the social life of elderly Canadians does not revolve around their children or other family members, contrary to what has been reported in other countries where similar studies were done.[17-19] It would be interesting to study ethnic differences in Quebec and to compare these results with the results of our study.

Our results suggest that some social integration activities, such as going to community social centres and, to an even greater extent, being involved in volunteer work, are associated with less depression in men but not in women. However, no association was found between attending religious services and the presence of a depressive disorder in either men or women. This suggests that attendance at a religious centre, in spite of increasing the opportunities for social interaction, does not play a key role in depression in older adults in Quebec, unlike other types of group activities.

According to Canadian data published by the 2007 Canada Survey of Giving, Volunteering and Participating,[38] 36% of older adults are involved in volunteerism, defined as unpaid, freely chosen activities within an organization.

The benefits of volunteerism for depression are supported by the results of various studies.[21,22,39] According to other research,[23,40] volunteerism could be conducive to mental health through social integration, use of one's skills and reinforcement of the feeling of being useful. However, our study is cross-sectional and it is also possible that depressed people are unable to volunteer.

In addition, our results showed that gender differences in depression were very large among those engaged in volunteering. In fact, volunteerism was not related to depression in women but was strongly associated with reduced depression in

TABLE 2 (*continued*)
Distribution of social relationships in women and men aged 65 and over in Quebec (N = 2670)

Variables	Men (n = 1073) %	Women (n = 1597) %	*p* ($\chi 2$)
Social support			
Presence of a confidant			.012
Yes	85.4	88.7	
No	14.6	11.3	
Instrumental support			.97
Yes	95.9	95.9	
No	4.1	4.1	
Emotional support			.35
Yes	95.2	96.0	
No	4.8	4.0	
Conflictual relationships			
Children			.08
No conflicts	66.1	62.6	
Conflicts	20.3	24.0	
No children	13.6	13.4	
Siblings			.44
No conflicts	73.6	71.3	
Conflicts	17.1	18.7	
No siblings	9.4	10.0	
Friends			.20
No conflicts	71.6	74.2	
Conflicts	15.7	15.2	
No friends	12.7	10.6	
Partner			< .001
No conflicts	16.8	7.6	
Conflicts	40.4	29.0	
No partner	42.8	63.4	

Abbreviations: $\chi 2$, chi-square test; <, less then; n, sample size; N, overall sample size; %, percent; *p*, p-value.

men. We could suggest two not exclusive explanations. First, in this cohort of older adults, regardless of whether or not they had worked outside the home, women maintained their role as homemakers as they aged whereas for men, who had lost their role as active workers upon retirement, volunteerism gave them the opportunity to continue being productive. Second, the number and nature of volunteer activities seem to differ for men and women. The 2007 Canada Survey of Giving, Volunteering and Participating[38] showed that women devoted more time to volunteer work than men, but that men devoted more time to volunteering in physical activities. Also, since volunteering usually stems from a sense of community, it could be important to determine if the benefits of volunteering for mental health depend on the duration and history of volunteering. Further studies could document other aspects of volunteer activities (the nature and intensity, etc.) to identify if specific aspects could play a protective role in depression in older adults.

The lack of a confidant was positively related to depression in both men and women. Since associations with depression and lack of instrumental support in men and lack of emotional support in women were attenuated after adjusting for health status, we tested for the presence of interactions between both types of social support and physical health, to verify if social support was only effective among those with poor health as it has been previously reported for mild depression (analysis and results of these tests are not shown).[41] However, these interactions were not significant in men or women.

Finally, our results show that conflict in the relationships with offspring and siblings do not seem to have any effect on depression. Non-conflictual relationships with a partner seem to be associated with a low probability of depression in both men and women. This fits with the findings of Antonucci et al. that negative social relations are associated with depression for both older women and men.[13]

Limitations

The limitations of this study include the fact that it is cross-sectional, which limits our ability to establish a chronological link between social relationships and depression. Some associations may be inverse, e.g. the presence of depression may lead to poor perceived health, less volunteering, less social integration and to more conflicts with the partner.

The ESA survey response rate of 66.5% is similar to that of other Canadian health surveys of older adults.[42] This could result in a selection bias and under-evaluation of depression since those who did not participate in the study could be the oldest or more cognitively impaired elderly people, as has been shown in other studies.[43] As no information was available on non-respondents to the ESA study, assessment of this selection bias was not possible. In addition, all potential participants with a score of less than 22 on the MMSE were excluded from the study. Therefore, the results can be generalized only to the older adult population with good cognitive functions and not living in the remote Northern areas of Quebec (Côte Nord, Gaspé Peninsula, Magdalen Islands, Saguenay-Lac-Saint-Jean and Abitibi-Témiscaminque).

Despite these limitations, the study used a large representative sample of community-dwelling older adults in Quebec. In

TABLE 3

Odds ratios for depressive disorders by social relationships and gender in women and men aged 65 and over in Quebec (N = 2670)

	Men (n = 1073)		Women (n = 1597)	
	OR[a](95% CI)	OR[b] (95% CI)	OR[a] (95% CI)	OR[b](95% CI)
Marital status				
With partner	1	1	1	1
Separated or divorced	1.28 (0.62, 2.65)	1.26 (0.61, 2.60)	1.43 (0.90, 2.25)	1.52 (0.95, 2.43)
Widowed	3.00 (1.62, 5.53)	2.97 (1.60, 5.51)	1.28 (0.90, 1.82)	1.35 (0.95, 1.93)
Never married	1.38 (0.54, 3.51)	1.39 (0.55, 3.53)	1.11 (0.65, 1.87)	1.22 (0.72, 2.09)
Children				
Yes	1	1	1	1
No	0.80 (0.39, 1.62)	0.77 (0.38, 1.57)	1.24 (0.85, 1.81)	1.24 (0.84, 1.81)
Siblings				
Yes	1	1	1	1
No	0.84 (0.35, 1.99)	0.78 (0.33, 1.86)	1.31 (0.85, 2.02)	1.26 (0.81, 1.95)
Friends				
Yes	1	1	1	1
No	0.75 (0.36, 1.58)	0.75 (0.36, 1.58)	0.96 (0.62, 1.48)	0.85 (0.55, 1.33)
Diversity of ties				
Low	1.27 (0.58, 2.78)	1.18 (0.54, 2.59)	1.78 (1.00, 3.14)	1.60 (0.90, 2.85)
Medium	0.72 (0.41, 1.26)	0.68 (0.39, 1.20)	1.39 (0.85, 2.25)	1.37 (0.84, 2.23)
High	1	1	1	1
Social integration				
Social centres				
Yes	1	1	1	1
No	1.74 (1.05, 2.87)	1.69 (1.02, 2.80)	1.04 (0.80, 1.36)	0.92 (0.70, 1.21)
Volunteering				
Yes	1	1	1	1
No	2.43 (1.35, 4.36)	2.33 (1.29, 4.20)	1.24 (0.93, 1.65)	1.09 (0.81, 1.46)
Attending religious services				
Yes	1	1	1	1
No	0.91 (0.56, 1.47)	0.92 (0.60, 1.48)	1.18 (0.91, 1.55)	1.12 (0.85, 1.47)
Social support				
Presence of a confidant				
Yes	1	1	1	1
No	1.87 (1.10, 3.17)	1.88 (1.11, 3.21)	1.73 (1.20, 2.49)	1.56 (1.08, 2.26)
Instrumental support				
Yes	1	1	1	1
No	2.42 (1.04, 5.63)	2.33 (0.99, 5.46)	1.55 (0.89, 2.70)	1.32 (0.74, 2.32)
Emotional support				
Yes	1	1	1	1
No	1.28 (0.53, 3.10)	1.23 (0.51, 2.98)	1.80 (1.05, 3.10)	1.55 (0.89, 2.69)

TABLE 3 (*continued*)

Odds ratios for depressive disorders by social relationships and gender in women and men aged 65 and over in Quebec (N = 2670)

	Men (n = 1073)		Women (n = 1597)	
	OR[a](95% CI)	OR[b] (95% CI)	OR[a] (95% CI)	OR[b](95% CI)
Conflictual relationships				
Children				
No children	1	1	1	1
No conflicts	1.11 (0.53, 2.29)	1.13 (0.55, 2.34)	0.68 (0.46, 1.00)	0.70 (0.47, 1.04)
Conflicts	1.83 (0.83, 4.06)	1.81 (0.82, 4.01)	1.17 (0.77, 1.79)	1.11 (0.72, 1.72)
Siblings				
No siblings	1	1	1	1
No conflicts	1.08 (0.44, 2.63)	1.15 (0.50, 2.84)	0.67 (0.43, 1.04)	0.70 (0.45, 1.10)
Conflicts	1.36 (0.50, 3.70)	1.41 (0.52, 3.85)	1.07 (0.65, 1.76)	1.10 (0.66, 1.83)
Friends				
No friends	1	1	1	1
No conflicts	1.00 (0.47, 2.15)	1.00 (0.47, 2.14)	1.04 (0.66, 1.62)	1.18 (0.75, 1.86)
Conflicts	1.58 (0.65, 3.81)	1.61 (0.66, 3.89)	1.04 (0.60, 1.79)	1.16 (0.67, 2.01)
Partner				
No partner	1	1	1	1
No conflicts	0.35 (0.15, 0.81)	0.36 (0.15, 0.83)	0.45 (0.24, 0.85)	0.44 (0.23, 0.83)
Conflicts	0.58 (0.33, 1.01)	0.59 (0.34, 1.02)	0.88 (0.63, 1.23)	0.82 (0.58, 1.15)

Abbreviations: CI, confidence interval; n, sample size; N, overall sample size; OR, odds ratio.

[a] adjusted for age, income and type of region

[b] adjusted for age, income, type of region, number of chronic health problems and perceived physical health

TABLE 4

Odds ratio for depression in women and men aged 65 and over in Quebec: interactions between marital status and gender, and volunteering and gender

		OR (95% CI)[a]
Marital status		
Married	Men	1
	Women	2.47 (1.60, 3.83)
Separated/ divorced	Men	1.15 (0.59, 2.24)
	Women	3.68 (1.44, 9.40)
Widowed	Men	2.85 (1.64, 4.96)
	Women	3.34 (1.48, 7.57)
Never married	Men	1.66 (0.68, 4.02)
	Women	2.94 (0.98, 8.80)
Volunteering		
No	Men	1
	Women	2.47 (1.60, 3.83)
Yes	Men	0.43 (0.24, 0.77)
	Women	2.20 (1.01, 4.77)

Abbreviations: CI, confidence interval; OR, odds ratio; *p*, p-value.

[a] adjusted for age, income, type of region, number of chronic health problems and perceived physical health

Lemeshow-Hosmer goodness of fit statistic $p = .24$

addition, depression was measured using recognized diagnostic clinical criteria, unlike some other studies that used psychological distress measures. The study contributes to the scarce literature on the effects of social relationships, social support, and conflict on depression in older men and women.

Conclusion

Our results suggest that some specific aspects of social relationships could play a role in depression in older men and women in Quebec. The availability of a confidant and the absence of conflict with one's partner appear to be the specific aspects of social relationships most strongly associated with lack of depression. In addition, gender differential associations between marital status and depression and between social activities and depression were observed. Other longitudinal studies on the effect of volunteerism are needed to learn more about its effect on the incidence and remission of depressive disorders in older men and women.

Furthermore, the absence in this cross-sectional study of associations between networks of family and friends and the presence of depression in older adults does not exclude the possibility that these relationships could be important for some subgroups of older adults with specific needs. These subgroups could include individuals with functional disabilities or some ethnic groups. Therefore, it would be interesting to conduct research on the role of offspring and other family and friends in depression among the elderly population according to ethnicity.

Acknowledgments

This study was supported by the Canadian Institutes of Health Research (200403MOP). The authors thank the members of the Scientific Committee of the ESA Study who provided significant scientific advice.

References

1. Alvarado BE, Zunzunegui MV, Beland F, Sicotte M, Tellechea L. Social and gender inequalities in depressive symptoms among urban older adults of Latin America and the Caribbean. J Gerontol B Psychol Sci Soc Sci. 2007 Jul;62(4):S226-36.

2. Bebbington PE. Sex and depression. Psychol Med. 1998 Jan;28(1):1-8.

3. Sonnenberg CM, Beekman AT, Deeg DJ, van Tilburg W. Sex differences in late-life depression. Acta Psychiatr Scand. 2000 Apr; 101(4):286-92.

4. Chou KL, Chi I. Prevalence and correlates of depression in Chinese oldest-old. Int J Geriatr Psychiatry. 2005 Jan;20(1):41-50.

5. Djernes JK. Prevalence and predictors of depression in populations of elderly: a review. Acta Psychiatr Scand. 2006 May; 113(5):372-87.

6. Jeon GS, Jang SN, Rhee SJ, Kawachi I, Cho SI. Gender differences in correlates of mental health among elderly Koreans. J Gerontol B Psychol Sci Soc Sci. 2007 Sep; 62(5):S323-9.

7. Piccinelli M, Wilkinson G. Gender differences in depression. Critical review. Br J Psychiatry. 2000 Dec;177:486-92.

8. Newman SC, Bland RC, Orn HT. The prevalence of mental disorders in the elderly in Edmonton: a community survey using GMS-AGECAT. Geriatric Mental State-Automated Geriatric Examination for Computer Assisted Taxonomy. Can J Psychiatry. 1998 Nov;43(9):910-4.

9. Ostbye T, Kristjansson B, Hill G, Newman SC, Brouwer RN, McDowell I. Prevalence and predictors of depression in elderly Canadians: The Canadian Study of Health and Aging. Chronic Dis Can. 2005 Fall;26(4):93-9.

10. Streiner DL, Cairney J, Veldhuizen S. The epidemiology of psychological problems in the elderly. Can J Psychiatry. 2006 Mar;51(3):185-91.

11. Glass TA, De Leon CF, Bassuk SS, Berkman LF. Social engagement and depressive symptoms in late life: longitudinal findings. J Aging Health. 2006 Aug;18(4):604-28.

12. Dean A, Kolody B, Wood P. Effects of social support from various sources on depression in elderly persons. J Health Soc Behav. 1990 Jun;31(2):148-61.

13. Antonucci TC, Lansford JE, Akiyama H, Smith J, Baltes MM, Takahahashi K, Fuhrer R, Dartigues JF. Differences between men and women in social relations, resource deficits, and depressive symptomatology during later life in four nations. J Soc Issues. 2002;58(4):767-83.

14. Prince MJ, Harwood RH, Blizard RA, Thomas A, Mann AH. Social support deficits, loneliness and life events as risk factors for depression in old age. The Gospel Oak Project VI. Psychol Med. 1997 Mar;27(2):323-32.

15 Bebbington P, Dunn G, Jenkins R, Lewis G, Brugha T, Farrell M, Meltzer H. The influence of age and sex on the prevalence of depressive conditions: report from the National Survey of Psychiatric Morbidity. Int Rev Psychiatry. 2003 Feb-May;15 (1-2):74-83.

16. Crohan S, Antonucci T. Friends as a source of social support in old age. In: Adams, R, Blieszner, R, editors. Older adult friendship: structure and process. Newbury Park, London (CA): Sage; 1989. p. 129-46.

17. Buber I, Engelhardt H. Children's impact on the mental health of their older mothers and fathers: findings from the Survey of Health, Ageing and Retirement in Europe. Eur J of Ageing. 2008;5(1):31-45.

18. Zunzunegui MV, Beland F, Otero A. Support from children, living arrangements, self-rated health and depressive symptoms of older people in Spain. Int J Epidemiol. 2001 Oct;30(5):1090-9.

19 Silverstein M, Bengtson VL. Does intergenerational social support influence the psychological well-being of older parents? The contingencies of declining health and widowhood. Soc Sci Med. 1994 Apr;38(7):943-57.

20. Kawachi I, Berkman LF. Social ties and mental health. J Urban Health. 2001 Sep;78(3):458-67.

21. Greenfield EA, Marks NF. Formal volunteering as a protective factor for older adults' psychological well-being. J Gerontol B Psychol Sci Soc Sci. 2004 Sep;59(5):S258-64.

22. Morrow-Howell N, Hinterlong J, Rozario PA, Tang F. Effects of volunteering on the well-being of older adults. J Gerontol B Psychol Sci Soc Sci. 2003 May;58(3):S137-45.

23. Musick MA, Wilson J. Volunteering and depression: the role of psychological and social resources in different age groups. Soc Sci Med. 2003 Jan;56(2):259-69.

24. Seeman TE. Health promoting effects of friends and family on health outcomes in older adults. Am J Health Promot. 2000 Jul-Aug;14(6):362-70.

25. Cairney J, Krause N. The social distribution of psychological distress and depression in older adults. J Aging Health. 2005 Dec;17(6):807-35.

26. Préville M, Boyer R, Grenier S, Dubé M, Voyer P, Punti R, Baril MC, Streiner DL, Cairney J, Brassard J; Scientific Committee of the ESA Study. The epidemiology of psychiatric disorders in Quebec's older adult population. Can J Psychiatry. 2008;(12):822-32. Available from: http://publications.cpa-apc.org/browse/documents/434&xwm = true

27. Mechakra-Tahiri S, Zunzunegui MV, Préville M, Dubé M. Social relations and depression among people 65 years and over living in rural and urban areas of Quebec. Int J Geriatr Psychiatry. 2009 Nov; 24:1226-36

28 Folstein MF, Folstein SE, McHugh PR. « Mini-mental states ». A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res. 1975 Nov;12(3):189-98.

29. Robins LN, Regier DA, editors. Psychiatric disorders in America: the epidemiologic catchment area study. New York: The Free Press; 1991.

30. Andrews G, Peters L. The psychometric properties of the Composite International Diagnostic Interview. Soc Psychiatry Psychiatr Epidemiol. 1998 Feb;33(2):80-8.

31. Murphy JM, Monson RR, Laird NM, Sobol AM, Leighton AH. A comparison of diagnostic interviews for depression in the Stirling County study: challenges for psychiatric epidemiology. Arch Gen Psychiatry. 2000 Mar;57(3):230-6.

32. Berkman LF, Glass T, Brissette I, Seeman TE. From social integration to health: Durkheim in the new millennium. Soc Sci Med. 2000 Sep;51(6):843-57.

33. Cohen S, Doyle WJ, Skoner DP, Rabin BS, Gwaltney JM Jr. Social ties and susceptibility to the common cold. JAMA. 1997 Jun 25; 277(24):1940-4.

34. Institut de la statistique du Québec. Enquête sociale et de santé 1998 [Internet]. Quebec (QC). Institut de la statistique du Quebec. Chapter 25. Le milieu social. 2001 Jan [cited on 2009 Nov 12]. Available from: http://www.stat.gouv.qc.ca/publications/sante/e_soc-sante98_pdf.htm

35. Institut de la statistique du Québec. Lexique du système du code géographique du Québec. Institut de la statistique du Québec [Internet]. 2007 Sep [cited 2009 Nov 12]. Available from: http://www.stat.gouv.qc.ca/publications/referenc/lexique.htm

36. Hosmer DW, Lemeshow S. Applied logistic regression. Toronto: Wiley; 1989.

37. Okabayashi H, Liang J, Krause N, Akiyama H, Sugisawa H. Mental health among older adults in Japan: do sources of social support and negative interaction make a difference? Soc Sci Med. 2004 Dec;59(11):2259-70.

38. Statistics Canada. Caring Canadians, involved Canadians: highlights from the 2007 Canada survey of giving, volunteering and participating [Internet]. Ottawa (ON): Statistics Canada; 2009 Jun [cited on 2009 Nov 12]. Catalogue No.: 71-542-XPE. Available from: http://www.givingandvolunteering.ca/files/giving/en/csgvp_highlights_2007.pdf

39. Li Y, Ferraro KF. Volunteering and depression in later life: social benefit or selection processes? J Health Soc Behav. 2005 Mar;46(1):68-84.

40. Butrica BA, Johnson RW, Zedlewski SR. Volunteer transitions among older Americans. The Retirement Project [Internet]. Washington (DC): The Urban Institute; 2007 Oct [cited on 2009 Nov 12]. Available from: http://www.urban.org/UploadedPDF/411582_volunteer_transitions.pdf

41. Beekman AT, Penninx BW, Deeg DJ, Ormel J, Braam AW, Van Tilburg W. Depression and physical health in later life: results from the Longitudinal Aging Study Amsterdam (LASA). J Affect Disord. 1997 Dec;46(3):219-31.

42. Canadian Study of Health and Aging Working Group. Canadian study of health and aging: study methods and prevalence of dementia. CMAJ. 1994 Mar 15; 150(6):899-913.

43. Van Beijsterveldt CE, van Boxtel MP, Bosma H, Houx PJ, Buntinx F, Jolles J. Predictors of attrition in a longitudinal cognitive aging study: the Maastricht Aging Study (MAAS). J Clin Epidemiol. 2002 Mar;55(3):216-23.

Book review

Statistical detection and surveillance of geographic clusters

Brenden Dufault, MSc

Authors: Ikuho Yamada and Peter Rogerson
Publisher info: Chapman & Hall/CRC, Florida
Publication Date: December 24, 2008
Number of Pages: 324
Format: Hardcover
Price: $89.95 USD
ISBN: 9781584889359

This aptly titled text focuses on statistical tests for the detection of spatial clusters and geographic temporal surveillance. It gives a thorough introduction to the mathematics, interpretation and practical issues behind the major methods of cluster detection and surveillance. It seeks to serve as an interdisciplinary bridge between the technical realm of spatial statistics and the diverse body of researchers in need of its tools. The themes range from very basic methods used for testing hypotheses of clustering in a region to complex approaches used for detecting, and simultaneously locating geographic trends over space and time.

The authors take an applied approach to explaining the theory and practice of spatial analysis, using many figures and realistic examples throughout the text. Particular emphasis is placed on public health applications: the authors make clear the potentially powerful role of spatial cluster analysis in public health research by providing historical notes on its use in epidemiology and by tailoring their examples and discussions to real health data, such as the spatial distribution of leukemia mortality. Readers with training in epidemiology will find the discussion of methods for case-control data useful. Each newly introduced method of geographic analysis is followed by clear illustrations, making the concepts more readily accessible than the mathematics of the topic might otherwise allow.

The book is divided into three main sections. The first is made of four chapters that provide an introduction to the fundamental concepts and describe the various methods of non-temporal cluster detection. This section begins by presenting approaches used for global tests, in which the entire region is tested against the null hypothesis of no clustering. This is followed by a discussion of the more sophisticated local tests, in which specific sub-regions of the study area are tested for clustering when the whole region is found to have global clustering. Spatial scan statistics are then introduced, which combine the above approaches by systematically searching a region for evidence of local clustering.

The second section consists of a single chapter and briefly reviews methods used for retrospectively detecting changes in spatial patterns. At this point the book moves from methods that are solely spatial to those incorporating aspects of time. It begins by discussing the Knox statistic, which tests for space-time interaction in a fashion conceptually similar to an analysis of contingency tables, and then moves to simpler methods for detecting temporal changes within a single region. The majority of the section, however, discusses methods specially designed for retrospective detection of geographic changes. The third section consists of four chapters and introduces a multitude of approaches used for geographic surveillance, including the prospective detection of changes in spatial patterns. These are extended to include methods for simultaneously monitoring multiple regions.

Each of the above topics is presented with rigorous mathematical notation and relies on statistical foundations. Readers easily intimidated by formulae or unfamiliar with concepts such as Poisson processes or autocorrelation may find some parts overly technical. The authors also periodically rely on vector algebra notation, calculus and Monte Carlo simulations to present the methods or to investigate their properties. At times, this emphasis on theory may overwhelm those without some training in statistics. Indeed, even with the appropriate training, the notation can be quite heavy, though the nature of the material likely makes this unavoidable. However, the authors' fluent writing style and the pragmatic structure of the book may allow readers without the necessary mathematics to nevertheless understand the main ideas in most cases. Those with even a modest background in applied statistics or geostatistics will find the concepts and notation to be presented in an intuitive fashion.

Geographic analysis has gained popularity within the public health field in recent decades, and so this book is a timely addition to the literature. Epidemiologists, biostatisticians, research demographers and social scientists engaging in spatial analysis will find this compilation to be a useful reference. As well, beginners

interested in familiarizing themselves with the methods and challenges of cluster analysis will profit from reading it. Students of geostatistics searching for an authoritative introductory text with an applied focus will also benefit from adding this to their library.

Announcements

SOPHE and Prevention Research Centers (PRC) Program Joint 2010 Conference
April 7-9, 2010
Atlanta (Georgia), U.S.A.
http://www.sophe.org/abstract_index.asp

CDC Diabetes Translation Conference
April 13-16, 2010
Kansas City (Missouri), U.S.A.
http://www.cdc.gov/diabetes

The Seventh International Metabolic Syndrome, Type II Diabetes and Atherosclerosis Congress
May 12-16, 2010
Marrakesh, Morocco
http://www.msdacongress.com/congress_2010/index.html

Canadian Society for Epidemiology and Biostatistics Student Conference
May 27-28, 2010
Kingston (Ontario), Canada
http://www.cseb.ca/conferences/student.php

Canadian Public Health Association Centenary Conference
June 13-16, 2010
Toronto (Ontario), Canada
http://www.cpha.ca/en/conferences/conf2010.aspx

The International Conference on Environmental Pollution and Public Health (EPPH2010)
June 21-23, 2010
Chengdu, China
http://www.icbbe.org/epph2010/

Society for Epidemiologic Research
June 23-26, 2010
Seattle (Washington), U.S.A.
http://www.epiresearch.org/

20th IUHPE World Conference on Health Promotion and Health Education
July 11-15, 2010
Geneva, Switzerland
www.iuhpeconference.net

International Congress on Obesity 2010
July 11-16, 2010
Stockholm, Sweden
www.ico2010.org

World Congress on Heart Disease
July 24-27, 2010
Vancouver (British Columbia), Canada
www.cardiologyonline.com

IDOF 2010 – 1st International Diabetes and Obesity Forum
October 21-23
Athens, Greece
http://www.idof2010.com

American Public Health Association Annual Meeting and Exposition
November 6-10, 2010
Denver (Colorado), U.S.A.
http://ahip.org

CDIC: Information for Authors

Chronic Diseases in Canada (CDIC) is a quarterly scientific journal focussing on the prevention and control of non- communicable diseases and injuries in Canada. Its feature articles are peer reviewed. The content of articles may include research from such fields as epidemiology, public/community health, biostatistics, the behavioural sciences, and health services or economics. CDIC endeavours to foster communication on chronic diseases and injuries among public health practitioners, epidemiologists and researchers, health policy planners and health educators. Submissions are selected based on scientific quality, public health relevance, clarity, conciseness and technical accuracy. Although CDIC is a publication of the Public Health Agency of Canada, contributions are welcomed from both the public and private sectors. Authors retain responsibility for the contents of their papers, and opinions expressed are not necessarily those of the CDIC editorial committee nor of the Public Health Agency of Canada.

Article Types

Peer-reviewed Feature Article: Maximum 4,000 words for main text body (excluding abstract, tables, figures, references) in the form of original research, surveillance reports, meta-analyses or methodological papers.

Status Report: Describe ongoing national programs, studies or information systems bearing on Canadian public health (maximum 3,000 words). Abstract not required.

Workshop/Conference Report: Summarize significant, recently held events relating to national public health (maximum 1,200 words). Abstract not required.

Cross-Canada Forum: For authors to present or exchange information and opinions on regional or national surveillance findings, programs under development or public health policy initiatives (maximum 3,000 words). Abstract not required.

Letter to the Editor: Comments on articles recently published in CDIC will be considered for publication (maximum 500 words). Abstract not required.

Book/Software Review: Usually solicited by the editors (500-1,300 words), but requests to review are welcomed. Abstract not required.

Submitting Manuscripts

Submit manuscripts to the Managing Editor, Chronic Diseases in Canada, Public Health Agency of Canada, 785 Carling Avenue, Address Locator 6805B, Ottawa, Ontario K1A 0K9, e-mail: cdic-mcc@phac-aspc.gc.ca.

Since CDIC adheres in general (section on illustrations not applicable) to the **"Uniform Requirements for Manuscripts Submitted to Biomedical Journals"** as approved by the International Committee of Medical Journal Editors, authors should refer to this document for complete details before submitting a manuscript to CDIC (see **< www.icmje.org >**.

Checklist for Submitting Manuscripts

Cover letter: Signed by all authors, stating that all have seen and approved the final manuscript and have met the authorship criteria including a full statement regarding any prior or duplicate publication or submission for publication.

First title page: Concise title; full names of all authors and institutional affiliations; name, postal and e-mail addresses, telephone and fax numbers for corresponding author; separate word counts for abstract and text.

Second title page: Title only; start page numbering here as page 1.

Abstract: Unstructured (one paragraph, no headings), maximum 175 words (100 for short reports); include 3-8 keywords (preferably from the Medical Subject Headings (MeSH) of Index Medicus).

Text: Double-spaced, 1 inch (25 mm) margins, 12 point font size.

Acknowledgements: Include disclosure of financial and material support in acknowledgements; if anyone is credited in acknowledgements with substantive scientific contributions, authors should state in cover letter that they have obtained written permission.

References: In Vancouver style (consult a recent CDIC issue for examples); numbered in superscript in the order cited in text, tables and figures; listing up to six authors (first three and et al. if more); without any automatic reference numbering feature used in word processing; any unpublished observations/data or personal communications used (discouraged) to be cited in the text in parentheses (authors responsible for obtaining written permission); authors are responsible for verifying accuracy of references.

Tables and Figures: Send vector graphics only. Each on a separate page and in electronic file(s) separate from the text (not imported into the text body); as self- explanatory and succinct as possible; not too numerous; numbered in the order that they are mentioned in the text; explanatory material for tables in footnotes, identified by lower-case superscript letters in alphabetical order; figures limited to graphs or flow charts/templates (no photographs), with software used specified and titles/footnotes on a separate page.

Number of copies: If submitting by mail, one complete copy, including tables and figures; one copy of any related supplementary material, and a copy of the manuscript on diskette. If submitting by e-mail to cdic-mcc@phac-aspc.gc.ca, please fax or mail the covering letter to the address on the inside front cover.